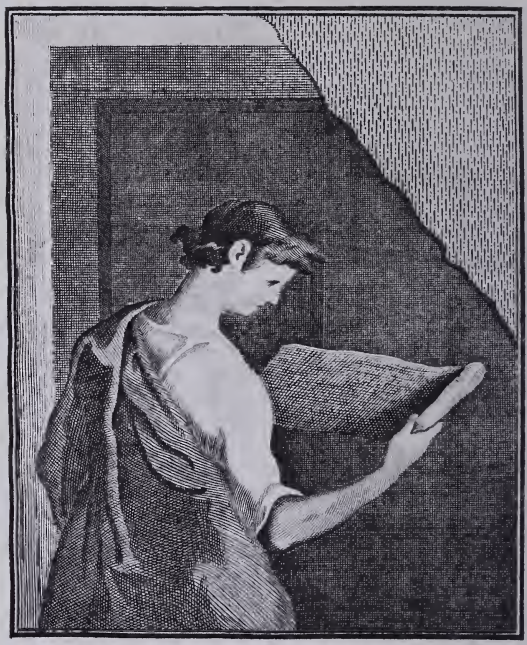
THE WOODWORKER SERIES

FRETWORK



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FRETWORK

THE WOODWORKER SERIES

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THE WOODWORKER SERIES

FRETWORK

FRETCUTTING, INLAYING AND OVERLAYING

171 ILLUSTRATIONS

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FOREWORD

FRETWORK has for long ceased to be regarded purely as a pastime for boys, and the attention now given to it by skilled woodworkers seems to call for a volume dealing fully with its advanced as well as its more elementary aspects.

If the present writer has any special claim to be the author of such a volume, it is not merely that he has been a life-long fretcutter, but that he has probably written more on the subject and has produced a larger number of published fretwork designs than any other living man. To-day, he believes, fretwork may fairly claim to rank with woodcarving, inlaying, repoussé work, etc., as a genuine art craft. Much of what we see may be inartistic, but so also is much of the carving and metalwork that we find. The majority of fretcutters—like the majority of other craftsmen—are dependent on published designs for their work. It is here, too, that fretwork scores. Many of the designs now procurable are graceful in proportion and outline and refined in detail; and it is now possible to produce from thin fretwood, without the aid of the ordinary cabinet-maker's tools, an ornament which is at once artistic, strong and useful.

Some of the designs illustrated in the volume

originally appeared in *The Woodworker*. To the proprietors of *Handicrafts* the author is indebted for permission to make partial use of some matter contributed a few years ago to that journal, and also for the liberty of reproducing miniature sketches of several designs published by them.

J. C. S. BROUGH.

December, 1919.

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WHAT CAN BE DONE WITH THE FRETSAW

WHAT THE FRETSAW CAN DO—ITS WIDER SCOPE—THE ARTISTIC SIDE OF FRETWORK—TOYS—DESIGNS.

TO make articles of use or ornament is the natural ambition of every man, just as it is the dream of every healthy boy. Many of us succeed. Some of us fail; not so much through lack of aspiration or ability, but simply because our energies have never been directed into a channel that seems to interest us. To those who have missed this channel in piloting their way, the numerous possibilities of fretsawing may be commended.

What the Fretsaw can do.—Used even in its simplest way, the fretsaw can produce many little useful articles for the home. These, too, need not be fragile; they may be plain and substantial. The ordinary household tools do not provide us with the means of turning out the neatly shaped objects which we can quickly cut with the fretsaw; but a few shillings spent on the necessary fretcutting tools will enable us to fit up handy matchbox brackets and watch-stands where they are likely to be required, to add finger plates to doors, to provide key racks and pipe racks, to make all kinds of toys and models, and to furnish the home with endless little fitments which help to make household work a little easier.

Then, from smaller articles of utility we proceed to something more ornamental. The little mantel clock will look better in a handsome case, and this we can make. For the bedroom we wish a small bookshelf for a few pocket volumes, and suitable designs for this are

within our reach. For miscellaneous curios or ornaments we need brackets which will not only show these to advantage, but will improve the appearance of the room. Of such we have a wide choice within reach. We are deluged with photographs of friends ; and, if we are at a loss to know what to do with these, it is open to us to cut suitable frames to receive them. The dressing-table needs a handkerchief or glove-box ; well, these we can provide. The plain thermometer or barometer can be mounted ; flower vases can be furnished with stands ; and in an extraordinary number of ways odd wall spaces may be covered and unattractive objects transformed into ornaments with a skilled and patient use of the fretsaw.

Wider Scope.—But if the possibilities of fretcutting were limited to these smaller articles, there would be little call for this volume. Its scope is wider. Heavy articles of furniture are never designed for the fretsaw but furniture of the lighter type can be constructed even by those who have had no experience in cabinet-making. The work itself is not *cabinet*-making ; it is fretwork, and pretends to be nothing more. But the writer has seen many neat drawing-room tables, overmantels, hanging bookshelves, wall cabinets, and other articles of furniture, made entirely with fretcutting tools, and which, without being cabinet-work, were strong and serviceable examples of artistic woodcraft. Some which he has himself made have stood the wear and tear of thirty years.

In addition to making the larger type of ornament which may be classed as furniture, the fretcutter has matchless facilities for the construction of imposing models. The field here is illimitable. Every building or engineering structure does not lend itself to fretwork reproduction, but there are many cases where only the fretsaw will produce the desired effect. The writer thinks he may lay claim to having designed the great majority of patterns for imposing fretwork models which

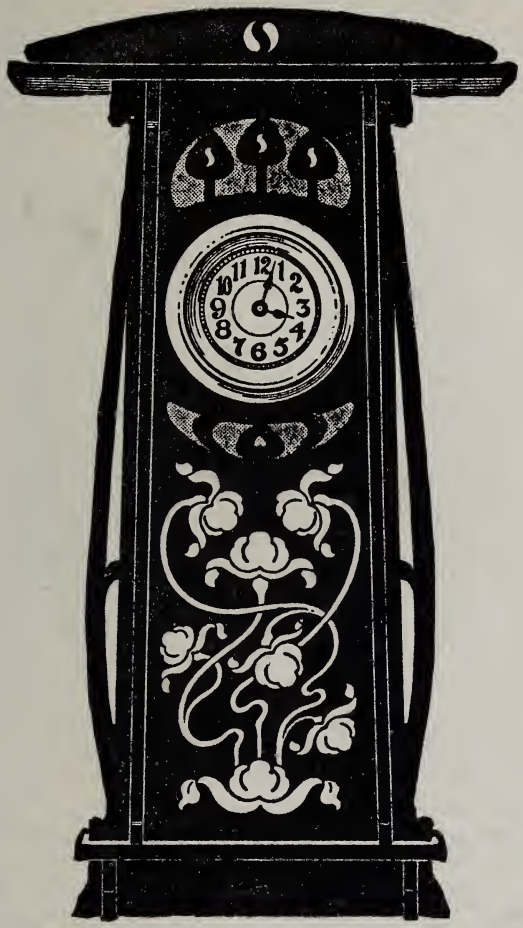

FIG. I.—A HANDSOME TIMEPIECE.

Designed by the Author. *Published by "The Woodworker."*

have been published, and he is aware that they have been made up in very large numbers. Model making is

FIG. 2.—OVERLAID JAPANESE BRACKET.

Designed by the Author. *Published by "The Woodworker."*

a most fascinating woodwork pastime, and in this branch of the subject the fretcutter has endless opportunities.

The Artistic Side of Fretwork.—This is developed as the fretcutter progresses in his work, and overlaying

and inlaying are fully dealt with in later chapters. The reader must not stay his hand at ordinary fretcutting if he wishes to satisfy himself and evoke admiration for his work. The illustration of the overlaid Japanese bracket opposite is an example of what may be achieved by fairly simple overlaying, and when well-designed overlays are mounted on comparatively plain panels of figured wood the combination is remarkably fine.

Indeed, what has really done much towards restoring fretcutting to its place among the art crafts is the

FIG. 3.—FRONT OF INLAID OR OVERLAID WORKBOX.

development of the overlay. The superimposing of a beautiful fret on a solid ground removes one of the rooted objections to old-fashioned fretwork—namely, its fragile qualities. The fret itself may be as rich and delicate as one wishes ; yet, when fixed to its background, there is no danger of its coming to any harm. The sense of flatness, too, is removed ; but, although relief is secured, there is not the old trouble of the fretted edges becoming receptacles for dust, as these in an overlay are too thin to permit much dust to accumulate, and in any case dust can be removed without the old risk. Overlays are carried out in wood, brass, aluminium, and in xylonite, and by careful choice in the background wood

many excellent effects may be had. It is not by any means the most elaborate piece of work that is the most beautiful, and the artistic design is not always the one on which most time has been spent. What, at the outset, the reader may be assured of is that, with fret-cutting tools, he can produce work which will be acknowledged as genuinely artistic woodcraft.

FIG. 4.—JOINTED DOG.

Toys.—The intervention of war in 1914 created many home toy-makers in this country, and perhaps the majority of these were men who worked with the fret-saw. This subject is also dealt with later ; but it may just be mentioned that, during the years of war, hundreds of amateurs added substantially to their incomes by making and selling fretwork toys. Indeed, fretcutting as a means of profit has now developed into what may almost be regarded as a new trade.

Designs.—In designs from which to select, the fret-cutter has an advantage over the cabinet-maker, wood-

carver, turner and all other craftsmen. In no other branch of handcraft are so many excellent designs available. The plain fact is that designers have restored to the fret its rightful place in woodwork decoration. For a time the issue broadcast of terrible designs which appealed to the hungry imagination of boys drove the artistic fret into the background. Even yet, crude reproductions of such designs may be seen ; but, just as

FIG. 5.—AN EXAMPLE OF OVERLAY WORK.

we pass over inferior woodwork and metal-work in other branches, so we can afford to ignore much of the ornate fretwork which is occasionally before our eyes.

The man who can use other tools skilfully will find little difficulty in mastering the fretsaw. It is largely a question of control, and it is probably easier to control a fretsaw than a chisel or gouge. Fretcutting as a branch of woodwork has reached a stage when it can no longer be ignored by the skilled craftsman, who will find himself left in the rear if he neglects its possibilities.

TOOLS AND ACCESSORIES

SAW-BLADES—FRAME—CUTTING TABLE—DRILL—FILES—GLASS-PAPER BLOCK—MISCELLANEOUS TOOLS—ACCESSORIES—THE WORK ROOM.

THIS volume deals with fretcutting as an artistic woodcraft. A generation ago it was regarded as merely a boys' pastime ; but, due alike to business enterprise and skilled designers, the last twenty years have witnessed a remarkable development which has given the delicate fret-saw blade a distinctive place amongst woodworking tools.

It is true that, just as a boy will seize a saw and a hammer, and knock up a rude hutch that amazes his own rabbits, so he purchases a fretwork outfit and hangs upon his wall the flowery bracket or photograph frame at which in later years he smiles. The fact that it is easy to acquire some little proficiency in fretwork and that no heavy initial outlay is necessary means that, as a pastime, it is frequently taken up and as quickly dropped. So is carpentry, and so are other crafts. This is a phase which need not concern us. The skilled cutter soon learns the possibilities of his craft. Being almost wholly dependent on the designs of others, he may not always be satisfied with the result of his work ; but, as he acquires taste and judgment, and as genuinely artistic designs come within his reach, he knows he can produce work which will win the admiration even of those who hitherto refused to recognise fretcutting as a handcraft. It must be remembered that the fret-saw does more than turn out the fragile, dust-collecting ornament which is often the despair of housewives. It traces the delicately

curved lines of the rich overlay, and gives us the quieter grace of the inlaid panel.

It is of fretcutting in its truly ornamental aspect that the writer desires to speak. At the outset, too, he may as well say that, all through, he intends to lay emphasis on the necessity for good work and careful finish. The one rock ahead of the novice is this : of all handcrafts fretcutting is the one by which decorative and useful articles for the home or for sale can most easily and most quickly be made. Once, too, there was a time when people did much fretcutting without pausing to consider whether it was good or bad. Indifferent work is still seen in abundance, but otherwise things are changed. There are thousands of skilled cutters all over the country who turn out the finest work, and this has so raised the standard of excellence that the aim is, not to see how *much* work can be produced in a certain time, but how *good* everything done may be. Experienced fretcutters would say that a writer did not know what he was talking about unless he emphasised the importance of good workmanship at every stage.

Outfit.—Leaving for a moment the question of a treadle fretsaw, the outlay on tools and materials is inconsiderable. Materials, indeed, are procured as required, and in the first instance only the essential tools need be purchased. For the constructional part of the work some of the ordinary tools in a woodworker's kit will serve the purpose until the cutter finds out what are his actual needs.

Just as the carpenter or woodcarver prefers to buy his tools singly, so the fretcutter does well to avoid the so-called complete outfits. Against these there is nothing to be urged so long as the tools are good ; but, just as each man learns by experience which tools best suit him, so is it wiser to purchase the right one as required instead of beginning with a miscellaneous set of appliances, some of which may rarely be required.

Saw-Blades.—The essential tool in ordinary fret-cutting, in overlaying and inlaying is the saw—or, as it is usually termed, the saw-blade. This is made from steel wire 5 ins. long, and, although so delicate that the teeth of the finest are hardly visible to the naked eye, it will cut wood of even an inch in thickness when necessary. Saws are purchased by the dozen, or by the gross, and only the best should be used, no matter what they cost. A beginner, before he has control over his tools and understands the waywardness of grain, will break many saws, but a dozen in the hands of an experienced cutter will last a long time. The " best " saw-blade is not necessarily the property of any one maker; it is the saw with which the cutter turns out his best work —the one he finds will do just what he wishes.

Something of the qualities of a really good saw should, however, be understood. For metal cutting saws are formed with the teeth close together, the reason being that metal can best be cut with a series of short strokes. In wood saws it is desirable to have the teeth wider apart. Unlike metal, wood has a grain, and if the teeth are too close the blade cannot ease itself, but gets locked in the close fibres of the wood. Some woods, too, are gummy, and in such cases a close-toothed saw gets clogged in the grain.

The process of manufacturing a saw with teeth wide apart is more costly than the other; hence the reason why cheap foreign blades have, usually, close-formed teeth.

Good saws, which have their teeth fairly wide apart, have also the points of the teeth sharpened by an ingenious process. They are, moreover, better tempered, and the back of the blade is slightly rounded. To the eye, the back of a fretsaw blade is hardly discernible from the edge or the side; but it is there, and the rounding referred to means that any roughness on the corners is removed, and that thus the course of the saw in turning

an angle is not diverted. Any flaw is liable to throw the saw off the pattern line when cutting, and the reason why the best blades are more expensive than inferior ones is simply that more elaborate methods of manufacture are employed to remove those faults which are so exasperating to the worker who uses a cheap make.

Saws, although spoken of as in "sizes," are all the same length, and vary only in gauge. There are eight or ten sizes, the finest being labelled oo or ooo. The most delicate blades, which remove the minimum of sawdust, are used for inlaying. For fine overlays the next number (o) is useful, while for ordinary fretcutting Nos. 1 and 2 are generally used. The larger sizes are not greatly in demand, although occasionally used in open designs. For bold work in thicker wood Nos. 4, 5 and 6 are used.

The finest saws have practically neither width nor thickness, and with these a novice obviously finds a difficulty in cutting straight. The width of a larger size helps to keep the blade in the kerf, and for this reason it is wise to begin with a medium gauge, such as No. 2.

Saw Frame.—To hold the saw-blade a hand frame (sometimes called hand fretsaw) is required. This is a two-armed steel frame, with a turned wood handle, and upper and lower clamps for holding the delicate saw-blade. Some form of tension screw is provided for keeping the saw rigid. Here, again, it is wise to procure the best (although not necessarily the largest) tool. Several types of excellent British-made frames are available, and improved types will probably be forthcoming.

The requirements of a good frame are: arms, of good steel and perfectly true; handle, comfortable to hold and securely fixed; saw clamps, rigid, with closely-gripping jaws and with hardened steel screws, the thread of which will not readily strip; and, lastly,

adequate means of securing the tension of the saw. The most important detail is the clamp. Any frame is useless if the clamp refuses to hold the saw-blade tightly. The strain on this is necessarily great. The saw itself has to be tightened so that it gives a musical note when touched, and the original strain is increased with the friction of cutting.

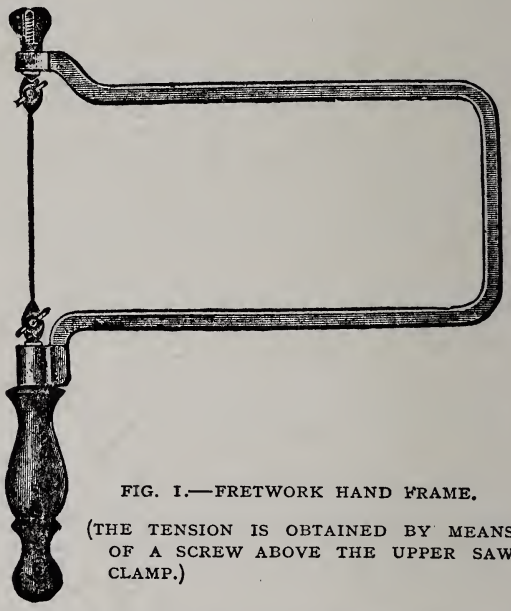

FIG. I.—FRETWORK HAND FRAME.

(THE TENSION IS OBTAINED BY MEANS OF A SCREW ABOVE THE UPPER SAW CLAMP.)

The means of securing the tension of the saw varies in the different makes of frame. The cheapest kind, which need not be considered, have no tension screw, and the saw is kept rigid merely by bending the arms while the blade is being fixed. Thus the spring in the arms gives the tension. Some frames have a screw within the handle which raises and lowers the bottom

clamp ; others have, in addition, a screw attached to the upper clamp. Some have a lever to the upper clamp, whilst others of recent make have a tension screw at the back of the frame which regulates the tension in a simple way. As a rule the cutter prefers the particular method to which he is most accustomed.

Frames are made in different sizes, the length being determined by the distance between the saw-blade and the inner edge of the frame back ; in other words, the length of a frame is its clearance. The most usual lengths are 12 ins., 14 ins. and 16 ins. Larger sizes are 18 ins. and 20 ins., whilst smaller tools for metal work are supplied down to 6 ins.

The writer does not favour long-armed frames. They have certainly the advantage of clearing larger work, but an 18-in. or 20-in. frame is unwieldy in the hand, and quickly tiring to the wrist. A shorter arm (say, 14 ins. as an average) means that the tool is much better under control, and this affords easier and more accurate work. The question of tackling work which is larger than the frame will be dealt with later, and it need not meanwhile be supposed that a 12-in. frame will cut a board of wood only 12 ins. long.

Cutting Table.—Although the saw-blade and frame may be regarded as the only indispensable tools for fret-cutting, the more incidental ones may be mentioned. A work bench, essential to the carpenter, is not a necessity, as the work may be done at an ordinary table, but some form of cutting board is required. The illustration shows this. The cutting board is secured to the table or bench by means of two iron cramps, the upper arms of which lie in grooves prepared for them, so that they do not project above the surface.

Cutting tables may be bought or made at home. The former are convenient, but even the largest are on the small side. The most useful is one that the worker can make for himself. A serviceable size is about

12 ins. by 8 ins., as this will ensure even the largest piece of work keeping flat. Any hard wood will serve the purpose, and the thickness should not be less than

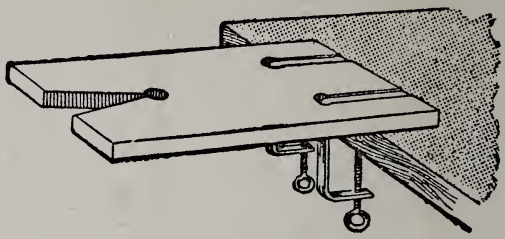

FIG. 2.—CUTTING TABLE—SHOWN CRAMPED TO AN ORDINARY TABLE.

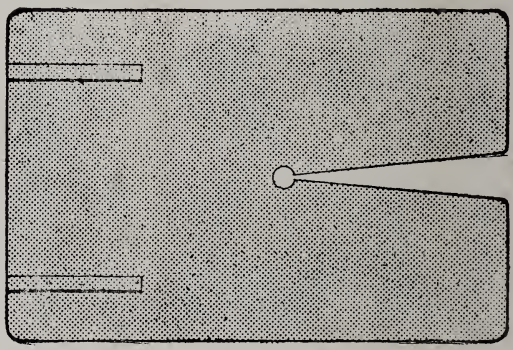

FIG. 3.—HOME-MADE CUTTING TABLE.
(SIZE ABOUT 12 INS. BY 8 INS.)

½ in. The V-shaped aperture, with its circle of about ¾ in. diameter, is for general work. A small side aperture might be added for finer cutting. If the apertures of cutting tables are too large the portion of fret being

sawn is not adequately supported. On the other hand, if too small, the saw-blade has insufficient freedom.

FIG. 4.—ARCHIMEDEAN DRILL.

FIG. 5.—DRILL WITH BALANCE WEIGHTS.

Metal tables are sometimes used, but these also are small, and the saw-blade is constantly apt to come in contact with the edge. The cutting table of a treadle

fretsaw is of metal, but in this case the saw-blade is kept automatically in the centre of the small circular opening.

Drill.—To secure access for the saw to interior openings a hole must be drilled; and, as the wood and other materials used for fretcutting are invariably thin, the ordinary bradawl or gimlet is too coarse for the purpose. By far the most useful type of tool for the purpose is the Archimedean drill (so called from the Greek mathematician and inventor who was born in 287 B.C.). This is illustrated at Fig. 4. Hardly any pressure is required, the downward stroke of the bobbin causing the spiral stock to revolve rapidly and drive the fine drill point through the wood.

An excellent type of similar drill is shown at Fig. 5. Above the chuck is a bar, at each end of which is a balance weight. As by this contrivance the drill revolves continuously in one direction, the bobbin may be drawn up to the top of the spiral stock for a second plunge without disturbing the bit.

Drill points may be had in several sizes. The larger ones are more useful for wood, whilst the finer ones are required for overlays and inlays.

If a bradawl is ever used for boring a hole in fretwood, take care that the point of the blade is placed *across* the grain. If inserted *with* the grain, it is almost certain to split the wood.

Files of a small size are specially made for fretcutting purposes. They are obtainable in various sections—square, round, triangular, flat, semi-circular and oval—and are used for sharpening the corners and cleaning up the ragged edges of a fret. Many workers shun files, and use, instead, narrow strips of glass-paper.

Glass-papering Block.—As every fret has to be thoroughly cleaned with glass-paper, a pad or block for

holding this is desirable. Without it there is a danger of slightly rounding the edges, and even of breaking the fret. The cabinet-maker's cork pad may be used, but much better for the purpose is the fretcutter's special block (made both in wood and metal), which is constructed to hold the glass-paper tightly. A thin felt pad is usually placed between the block and the paper.

Some Useful Miscellaneous Tools may be mentioned, although probably substitutes for each will be found at home.

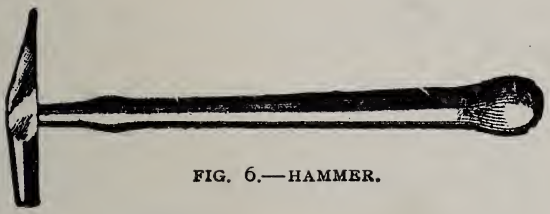

FIG. 6.—HAMMER.

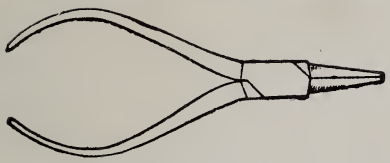

FIG. 7.—PLIERS

For the fine screws and nails required for fretted ornaments it is a great convenience to have a suitable screwdriver and hammer. For screws, a fine bradawl (kept solely for the purpose) is wonderfully handy, but the special fretcutter's fine-pointed screwdriver is well worth its little cost. As only fine-gauge screws, rarely over $\frac{1}{2}$ in. long, are used the blade point should not be more than about $\frac{1}{8}$ in. wide. A good quality tool pad, which includes a small countersink bit in addition to various sizes of bradawl points, is a luxury that may be added later.

The most useful type of hammer is one after the style

illustrated. Needle and pin points, as well as wire or brass nails, are used for fixing, and for the former the tapered end of the head is convenient. A magnetised head has an advantage which becomes very obvious in actual experience.

A pair of small flat-nosed pliers is one of the fretcutter's constant friends, indispensable in many ways, and a pair of heavier wire-cutting pliers is also useful. A straight-edge (or a two-foot rule) should be at hand, and no fretcutter's kit should be without a pair of pencil compasses.

Tools which, later on, may be required for more advanced fitting, such as a shooting board and iron plane,

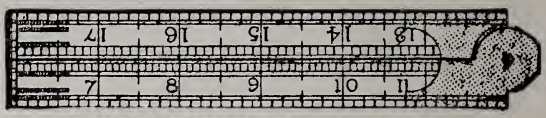

FIG. 8.—TWO-FOOT (FOUR-FOLD) RULE.

will be referred to when the particular subjects are dealt with.

Accessories.—These may be briefly summarised. A small supply of glass-paper is essential. Coarse sandpaper is never used, but a few sheets of medium, fine and "flour" glass-paper should be stocked. It is well to have a sheet of black or blue carbon paper for occasional tracing, and also a sheet of transparent tracing paper.

Screws may be purchased as required, but it is always wise to have a few in stock—$\frac{1}{4}$ in., $\frac{3}{8}$ in. and $\frac{1}{2}$ in. in the finest gauge. Brass screws are most frequently used, as they look better, but for the very hardest woods iron screws are sometimes required. A packet of assorted wire or brass nails, from $\frac{1}{4}$ in. to $\frac{3}{4}$ in., is always useful.

Glue may be made at home, but as it is seldom that any large quantity is required a prepared liquid glue is more handy. There are several makes of this, perhaps

the best known for reliability being croid, in tins, and seccotine, in tubes.

The Workroom.—Fretcutting may, of course, be carried on anywhere, but it must not be forgotten that the work creates a good deal of dust—not perhaps a dirty dust, but, still, plenty of it. Certain precautions may be taken to keep the dust within a limited area, but this is apt to be irksome to the cutter. Thus, while there is no reason why cutting should not be done in the parlour, kitchen, or even bedroom, the worker will feel far more freedom if he can find a small corner which he can regard as a workshop. Especially is this desirable where a treadle fretsaw is used. Carpets and curtains should be removed, as to these any sawdust will persistently cling.

The light in the room should be good, as the eye must be constantly kept on the pattern line. It is more pleasant to do fretwork by daylight than by artificial light, but as few can always enjoy this privilege it is idle to advise people to work only by day. In cutting by gas or lamp light, what has to be guarded against is allowing the shadow of the saw to fall across the line which is being cut. This, however, is not so much a question of the arrangement of the light as of the position of the worker, who will soon be able to adjust his seat to suit his own eye comfort.

As already indicated, there is no need to purchase a regular carpenter's bench. It may, of course, be granted that a bench is much better than a table, but a table—if reasonably strong—will do. Nothing can well beat an old kitchen table, but if a polished table is used it is well to provide a stout deal board on which drilling, glass-papering, hammering and general work may be done without the risk of injury to the table top. A chair with a wood or cane seat is better than an upholstered one, and an apron will protect the knees from accumulating sawdust.

PREPARATION OF WOOD AND DESIGN

TRANSFERRING AND DRILLING

WOOD AND DESIGN—DIRECTION OF GRAIN—ECONOMY IN WOOD—PASTING THE PATTERN—TRACING—DUPLICATING —DRILLING

ASSUMING that a design has been selected, the first consideration is the wood that should be used for this. Here the worker is at once faced with the first opportunity for exercising his judgment. He must decide which particular wood will best suit the article he is about to make ; or, if he has some fine wood in stock, he has to choose a design which will use it to the best advantage.

Correct judgment here is partly instinct and partly experience ; and, as experience is at least a valuable aid to natural taste, it is well that the fretcutter should accustom his eye to the finished aspect of various woods. A planed board of wood has its own beauty, but much of what was originally beautiful is cut away by the saw, and it is only by experience that we can gauge the difference that the actual cutting makes. If, for example, we admire a board merely because of its striking figure, we have to remember that this figuring will be broken up by the intersecting saw cuts ; consequently, something more than figure is required. What really is essential is that, in colour, texture and thickness, the wood will harmonise with the character of the design. We may like the colour of oak, but find the texture too coarse ; or, on the other hand, we may admire the smooth grain of maple, but feel that the colour is too light.

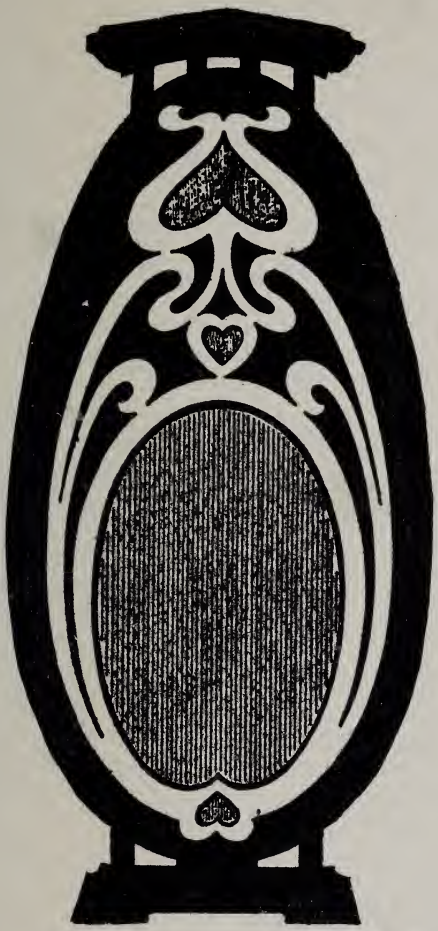

FIG. 1.—PHOTOGRAPH FRAME. 11 INS. BY $5\frac{1}{4}$ INS.

Designed by the Author.

A photograph frame like Fig. 1 may be taken as an example. The design, not being of a purely dainty character, is hardly one for which a white wood should be used. Its quieter lines seem to call for a dark wood. Being small, a coarse-grained wood is out of the question, and thus we need a wood which has a good even texture. Then, as the background is fairly solid, special strength is not required, and a moderately thin board can be selected. The result of our deliberation may, then, be that we decide on a piece of rosewood, not elaborately figured or too dark, taking this in a thickness of $\frac{3}{16}$ in. For the overlay, white may strike us as being in too violent a contrast with rosewood, and we may decide on satinwood or silverwood, either of which is appropriate.

In the case of larger articles, other considerations have to be weighed. The width of the design is one of these, and we are limited to woods which are obtainable in wide enough boards. Cost is another consideration, and if ten or twelve feet are required the difference of even sixpence per foot may, again, limit our choice. Then, if the object is being made for a definite purpose, the general surroundings have to be considered, and the wood chosen accordingly.

The Direction of Grain.—When the pattern is pasted or otherwise transferred to the wood, care has to be taken that the grain lies in the right direction. This is usually obvious, but occasionally serious errors of judgment are encountered. As a rule, the grain has to be upright with the design; that is, if the article is upright in character, the grain will run vertically. On the other hand, the sides of a shallow handkerchief or glove box usually look better if the grain is horizontal.

In cases where the grain may lie either way so far as appearance is concerned, the design should be studied, and then so arranged that the direction of the grain will support any delicate parts of the fret. Every one knows that the short grain of wood is brittle. The grain of a

12-in. rule lies lengthways; if made with the grain running across the narrow width the rule would break in a child's hand. The delicacy of the short grain will soon be understood when cutting, and more especially during glass-papering and fitting, and it is just as well that it should be realised at the outset.

Economy in Wood.—Then it is worth pointing out that, so far as the interests of the article will permit, the diagrams should be so arranged as to avoid the maximum of waste. In days when good wood could be bought for fourpence per square foot the waste of a corner was a comparatively small matter, but at present prices needless waste is extravagance. The direction of grain should never be sacrificed to economy, but with a little thought and care the worker may often avoid the necessity of cutting into a new piece of wood by the judicious scheming of smaller diagrams.

Economy can, of course, be better effected by those who invariably keep a few spare boards of different sizes at hand. If only one board is there, it must be used, no matter whether it cuts to waste or not; but when there are several to choose from the diagrams may be planned on one or other without any waste. Odd corners should be preserved, as these have a way of coming in handy for other work. Fretcutters who have a favourite wood which they use almost constantly are rarely victims of waste. Odd pieces which they accumulate are used for the smaller parts of different designs, and in this way the larger boards are reserved for the larger diagrams.

TRANSFERRING THE PATTERN.

Pasting.—This method of getting the pattern on the wood is mentioned first as being the simplest, most direct and most popular. Any other method involves tracing, and tracing involves just that amount of skill

in freehand drawing which the average woodworker lacks. Pasting, on the other hand, means that the diagram can be used only once, as it is cut away with the wood. Printed designs are very cheap, however, and this consideration is a minor one except in cases where a large number of similar articles have to be made. The cutting of two or more pieces of wood together—often called plural cutting—will be dealt with later.

Flour paste or starch is the best adhesive. Glue or gum should on no account be used, for if fixed with them the paper is afterwards very difficult to remove. The paste must be fairly thick, but not lumpy. If too thin it will soak the paper and cause it to stretch. Whether the paste be applied to the back of the paper or to the wood, what has to be guarded against is any tendency on the part of the paper to stretch. The younger fretcutter, when he has cut out an article and begins to put it together, is often staggered at finding that his joints do not fit. Not being conscious of having committed any glaring blunder, he blames the designer or the printer. Probably what has occurred is that he has allowed one diagram to get too wet with the moist paste, and then, in flattening it, has stretched it so that the joints are thrown out of position. It is well to realise that a narrow piece of paper about ten or twelve inches long will easily stretch out $\frac{1}{4}$ in. or more when damp.

The secret of success in pasting is to do the work quickly. Use a large stiff brush, do not take much paste on it, and apply it quickly. Then *immediately* lay the diagram down on the wood and rub it flat. If everything is done quickly the paper will have no time to stretch ; any delay, however, will cause the mischief. Do not rub direct on the diagram, but lay a sheet of paper over the diagram and rub on this. If rubbing is done at once the pattern will go down flat. Do not pull it out at the corners to smooth apparent irregularities, but rub down fearlessly and these will disappear.

Small diagrams may have the paste applied to the back, but in the case of large sheets it is wiser to apply the paste to the wood. Do not use too much, and, again, do not delay, but immediately lay down the design and rub it. With very large patterns it is a good plan to roll the paper round a round ruler ; then, when the wood has been pasted, gradually unroll the pattern and rub down. Pasting is a not unimportant preliminary. To do it well calls for some experience, but it will be found that confidence and rapidity of work go far towards success. On the other hand, moist paper will quickly take advantage of any hesitation or delay to play endless little pranks which may give a good deal of annoyance.

Work which has been pasted should never be cut, or even drilled, until it is thoroughly dry. As the moisture evaporates the paper contracts, and is apt to bend the wood. For this reason it is wise to lay the work flat on a table with a weight above.

Tracing with Carbon Paper.—This method of transferring is well known. A sheet of blue carbon paper is laid on the wood. Above this is placed the diagram, the sheet being secured with not less than four drawing pins. The entire diagram is then traced through on the wood by firmly outlining the pattern with a sharp-pointed H or HH pencil. Straight lines are ruled, and circles or parts of circles are described with compasses.

Carbon paper tracing is very useful in cases where small parts are required in duplicate. With large and intricate designs, however, the worker must decide whether he is equal to the task. If he can draw he will find several advantages in tracing, but if he has had little experience with his pencil the task before him will be laborious and perhaps not wholly satisfactory. Another consideration is that, whilst carbon paper yields a strong line on white wood, it leaves but a faint impression on darker woods like walnut and padouk. If the carbon is fresh the line will be fairly clear, but if worn the

impression is certain to be weak. Red carbon paper is available for dark woods like ebonia and rosewood.

Transparent Tracing Paper.—Those who like to preserve their designs use artists' transparent tracing paper as a substitute for carbon paper when dark woods are employed. This paper, which is quite transparent, is laid on the pattern, pinned down and a pencil copy made. The copy is then pasted to the wood. A small stock of transparent paper should always be kept. When one is pressed for time it is very useful for making duplicate copies. It is also handy for inlaying and underlaying and in many other ways. With carbon paper, in conjunction with transparent paper, two or more copies can be made at one tracing.

Duplicating Patterns.—With any of the various methods of making duplicates of patterns the writer does not pretend to have much sympathy. His point of view is that the design itself deteriorates under any duplicating method, and he holds that no work should be cut except from a perfect design.

Heel Ball.—For example, a fret has been cut out and the worker wishes to cut another. Instead of procuring a new design, he lays a sheet of white paper over the fret, takes a piece of shoemakers' heel ball and makes a rubbing. This he pastes down as his pattern. Now, the writer has often made such rubbings of frets, incised carvings and brasses, but these he has used for reference, and not as working patterns. In the case of a fret a perfectly sharp heel ball rubbing cannot be had. Any mistakes in cutting will be reflected on the rubbing ; and, although a rubbing may be utilised by a draughtsman for making a new drawing, it cannot be regarded as a satisfactory pattern for serious work.

Templates.—Then another plan is, when cutting two boards of wood together, to place a sheet of thin card or stout paper between them and thus secure a template.

For further designs this template is laid on the wood and the outline obtained by guiding a pencil around the cut edges. Here, again, it is impossible to get a perfectly accurate pattern. The template will reveal any faults in cutting, whilst, in tracing off, the pencil necessarily comes a little within each line.

If we are dealing with large open work in thick wood, such as decorative arches or screens, the heel ball or template method may be used ; but, for fine work, the reader is always advised to cut from the truest pattern available, and that is the original design. Designs are so cheap that the finished result is well worth the trifling extra cost.

Reverses and Halves.—It may sometimes happen that the worker wishes to cut a pattern the reverse way from that shown—say, left-handed instead of right-handed. If the design is printed in a dark ink a little oil may be rubbed over the back, and this will usually render the paper sufficiently transparent to make the outline clear. Failing this, it is easy to make a tracing on transparent paper and paste this to the wood face downwards.

Occasionally, too, it happens that only one half of a large diagram is shown, and the worker requires the other half reversed. In this case also a transparent paper tracing is the most satisfactory. If, however, the two halves are to be cut separately and afterwards joined both pieces of wood will be cut together. The expert cutter always aims at producing work which will appear finished on both sides.

Plain Diagrams.—When diagrams are perfectly plain, without shaped edges or interior fretting, it is a saving of trouble to draw them direct on the wood with pencil and rule. Plain parts are frequently necessary in the construction of an article ; whilst, in addition to these, we have plain overlays for photograph or mirror

frames. If rectangular, these may be ruled on, care being taken to keep them square ; if circular, they should be described with pencil compasses.

DRILLING.

Drilling is necessary to secure the access of the saw to interior parts of the fret, and is required for every diagram except those which are perfectly plain or have merely shaped outlines. The work is apparently simple, and yet drilling can be done in the wrong as well as in the right way. We have to bear in mind that, as a rule, we are dealing with fine material. The wood is thin and readily split unless care is taken ; the design is close, and the tool we use is a delicate one. Drills for fretwork have already been described.

Work to be drilled should preferably be clamped or temporarily nailed to an old table, or to a piece of thick but soft waste wood. This is desirable for two reasons. Both hands are required for working the drill, and some means should be taken to hold the work steady. If the board moves when the drill is in it there is a risk of the point breaking. Then, unless the thin fretwood is backed by something solid, the thrust of the drill is apt to tear the fibres of the grain on the underside and injure a part which may show on the finished work. If the board is fixed to a piece of waste wood a couple of small wire nails will be sufficient to hold it.

Where to Drill.—This is a more important matter than might at first appear. The fact is, we wish to drill close to the point where we intend to start cutting, and this should be determined when drilling. Interior spaces are of all shapes and sizes, but roughly they may be divided into three general classes : (1) those with projecting points, as Fig. 2, A ; (2) those without projections, but with corners, as B ; and (3) those without either points or angles, as C.

A projection is the easiest starting point because we strike directly on to the line. Failing this, a corner has to be taken. Circles and ovals are practically the only forms which have neither projections nor corners. The hole should be drilled near the point at which the saw will begin, but on no account must the hole come on the line.

How to Drill.—Drill bits vary in size, the finest of which are only used for inlaying. For general work a fairly stout bit is the most convenient, as it pierces a good hole which is easily found when wanted. Sometimes, however, when the interior opening is a very small

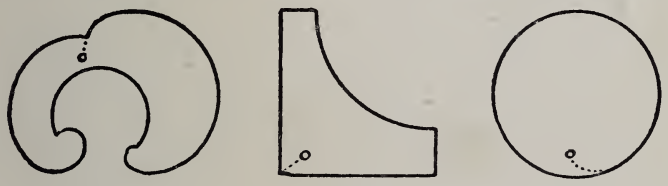

FIG. 2.—WHERE TO DRILL.

or narrow one, a finer bit must be chosen. The Archimedean drill stock should be held vertical, for if the hole is bored at an angle the saw may break when inserted and tightened. The steel drill bit is brittle, and may snap at the neck if handled carelessly. The risk of this usually occurs when withdrawing the bit. Draw it out straight, the drill stock being kept revolving all the time ; indeed, there should be no pause between the boring of the hole and the withdrawal of the bit.

Some treadle fretsaws are provided with drilling attachments, by which means the drilling can be done on the cutting table. Others have provision for a drill bit at the end of the balance wheel spindle. On the whole, however, a small Archimedean drill is the handier for most purposes.

CUTTING

POSITION OF WORKER—TENSION—CONTROL OF SAW—THE VERTICAL STROKE — SMOOTH CUTTING—SAW-BREAKING — ORDER OF CUTTING — FIRST PRINCIPLES IN CUTTING—ACCURACY

FRETCUTTING with a hand frame and fretcutting with a treadle saw are different matters. In treadle cutting the saw, which faces the worker, is stationary except for its regular stroke. The wood is held with both hands, and is so guided that the saw threads its way along the diagram line. In the case of the hand frame the teeth of the saw are away from the worker; the blade is brought to bear on the wood instead of the wood being fed up to the blade, and the guiding is done both by the hand which directs the saw and the hand which controls the work.

Treadle fretsaws will be referred to later. Many cutters use them; but, as many more work with the frame, and as our hints on cutting refer equally to both methods, this chapter may be regarded as dealing with the ordinary hand saw.

Position of Worker.—The cutter should be careful not to seat himself too high. This would involve stooping, and stooping—apart from being tiring—is apt to interfere with the proper movement of the arm. The wood cutting board is cramped to the table or bench with the V opening towards the sitter. On this board the work is held with the left hand. The saw is held in the other hand, and both hands are partners in determining the direction of the cut.

Tension.—Saw-blades are fixed in the hand frame with the teeth facing outwards and looking downwards.

If accidentally fixed so that the teeth face upwards all the sawdust is dragged to the surface and the friction of cutting will jerk the work up from the cutting table. At each end of the saw there is about an inch of spare steel, and care should be taken that these ends are properly and evenly locked in the saw clamps. The clamp screws must be sufficiently tight to permit the blade to stand the strain of tension and of cutting, but if turned too tightly there is a risk of stripping the screw.

The fineness and flexibility of the blade render it a tool which must be strung up tightly for use. The tension screw of the frame provides for this. The life of the blade need not be risked by screwing it up too tight, but it should be sufficiently rigid not to yield too readily when cutting is commenced. The happy medium cannot be defined in writing, and to some extent is a matter of taste, but experience will soon determine the tension that best suits the worker.

Control of Saw. — In nine cases out of ten the beginner at fretwork is his own teacher. In one or two out of these nine a man may mechanically drop into the right way, but in others the worker gains by experience the knack which has never been taught him. Much of the secret of success depends on early control over the hand frame. Like some other tools this will master the worker unless the worker masters it.

The fretsaw frame should be held firmly, but in such a way that the wrist has free play. The actual up-and-down movement is from the elbow, the wrist yielding just sufficiently to ensure that the arms of the frame keep horizontal throughout the stroke.

By control of the saw we are not speaking of control as applied to accuracy in cutting. Accuracy will follow if the tool is something we can do with what we choose, instead of (as it sometimes is) one which merely does what *it* chooses; and, before the final question of

accuracy come the preliminary necessities of a vertical stroke and smooth cutting.

The Vertical Stroke simply means that the saw blade must always be kept vertical. It is only by maintaining a vertical stroke that the cut edges of the wood can be truly square with the surface. One way in which the blade is thrown off the vertical is by letting the frame tilt forwards or backwards ; but a side tilt has worse results. There are two results : one, that the cut edge will be slightly bevelled instead of true ; the other that, consequently, the fretted outline on the underside will vary from that on the upper surface. In other words, it means that, although the saw is following the pattern line on the upper face of the wood, it is straying from what ought to be the corresponding line on the under face.

When rounding a corner or curve the beginner is apt to tilt the whole frame to the right ; whilst, with a straight length of line in front of him, he is inclined to hasten matters by using the delicate blade as if it were a carpenter's rip saw.

Smooth Cutting.—Smoothness is essential to good cutting. Even if the worker has never seen a treadle saw, he can picture in imagination how the blade moves rapidly up and down, always regular and always in the same vertical position. What he has to aim at is to so use his hand frame that the blade works with the same smooth, vertical regularity. This is far from impossible. What is wanted is, after mastering the hand frame, to work with smooth regular strokes, so that any saw marks left on the edge of the wood will be similar to those seen after treadle cutting. Forcing has to be avoided ; it is unnecessary. With hard woods progress may be slow, but good blades can find their way through any wood, and excessive pressure will only mar the edges. It is a good plan always to examine edges after a piece of wood

has been cut out. In this way the conscientious worker will soon find where he has been at fault.

Saw-breaking. — Coupled with the elementary difficulties in securing control over the hand frame, there is (especially on the part of younger beginners) the feeling of despondency when several saws break at an early attempt. Frequently one reason for these disasters is that too fine a blade has been used. Saw-blades are tender, and require a good deal of care. Nos. 0 and 1, however, are much more delicate than Nos. 2 and 3, and if a fairly bold piece of work is begun with the aid of a No. 3 blade there will be fewer breakages than if a design which required a No. 1 saw were attempted.

Fretwork saws, it is clear, will break with careless usage. But apart from this they break in ordinary course, and it is worth while for the worker to make a mental note of the way in which his first dozen blades have met their end. Some go at a corner, due probably to too sharp a turn ; some get locked in the wood and break at the effort to remove them ; some break through the exercise of over-pressure ; some slip from the clamps because they have not been tightly enough screwed ; others break in the various other ways calculated to bring their life to an end. Saw-breaking must be faced without discouragement. It is part of the work, and the more experience a worker gains the fewer blades he breaks.

Order of Cutting.—When the pattern is ready for cutting, it is a matter of some importance to decide whether the outline or the interior is first to be sawn. This depends chiefly on the character of the outline, but also partly on the amount of waste wood surrounding the diagram. Unless the pattern is a very small one it is desirable that the wood worked upon be as light as possible. By cutting the outline first the work is at once reduced to its smallest dimensions. It often

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happens, however, that the outline is elaborate, and that fragile projections may run the chance of getting broken when the interior parts are being sawn. Thus in each case a design must be judged on its merits.

Later on the order in which the interior parts are taken may also have to be considered. Sometimes the cutting of a certain opening will leave a delicate portion of the fret unprotected, and such an opening should be left till towards the end. This, however, is one of those matters which becomes obvious in actual practice, and on which no safe rule could be laid down without giving numerous illustrations.

First Principles in Cutting. — Some amateurs have a knack of readily adapting themselves to any operations of a mechanical nature; others are less fortunate, and have to face several preliminary failures. Some fretcutters turn out better work at their first attempt than others do at their fiftieth, but it is the same in every art, pastime or sport.

When the tool is mastered and the saw can be kept vertical this does not mean that the worker is already an accurate cutter; but it does mean that there is now no obstacle to prevent his becoming an expert. Good cutting is chiefly the result of being determined to cut well.

Accuracy means the careful following of the design line. (Occasionally one may come across a palpable error in a design, the result of a misprint, and accuracy involves the remedying of this.) To follow the line is less easy than wandering from it; but with practice the ability to follow the line is soon acquired, and, once acquired, accuracy becomes almost mechanical. Firstly must be learned the correct cutting of straight lines— not merely long straight lines without a break, but lines which are continuous, although intercepted at certain points, such as Figs. 1 and 2. Indifferent workers are

FIG. 1.—EXAMPLE OF A FRET WITH STRAIGHT LINES.

FIG. 2.—EXAGGERATED SKETCH OF FAULTS IN CUTTING.

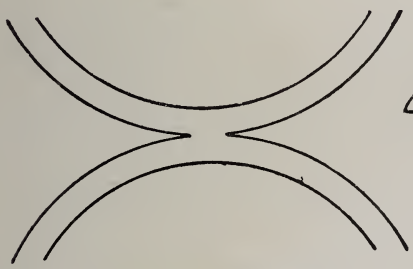

FIG. 3.—GEOMETRICAL CURVES.

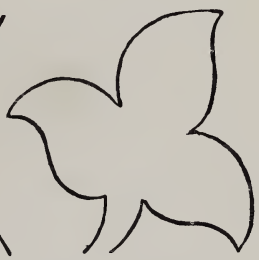

FIG. 4.—LEAF.

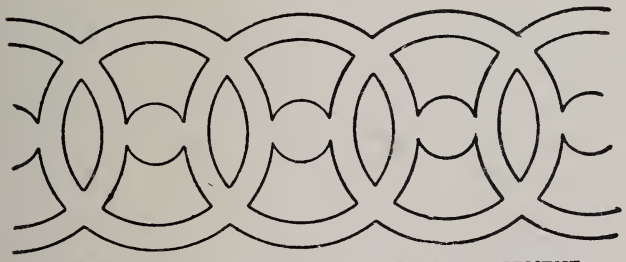

FIG. 5.—A DIFFICULT GEOMETRICAL ARRANGEMENT.

quite satisfied with themselves if they can secure a result like Fig. 2, under the impression that no one will detect the fault.

The faults in Fig. 2, so far as the " straight " line is concerned, are two-fold. There are (1) the irregularities at *a*, the result of paying no attention to the line being cut ; and (2) the faults at *b*, the result of not keeping an eye on the part of the line beyond the corner. As every fretcutter must learn to grasp, it is not what is being cut away that is of importance, but what is being left in.

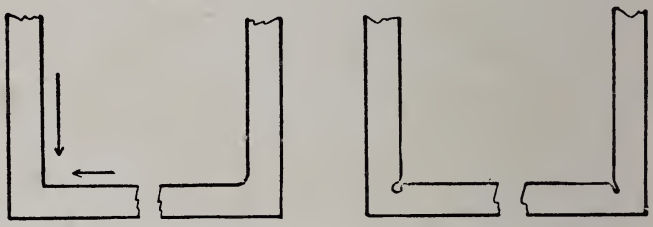

FIG. 6. FIG. 7. FIG. 8. FIG. 9.

FIG. 6 SHOWS THE WAY TO CUT A CORNER (*see* ARROWS). FIGS. 7, 8 AND 9 INDICATE COMMON FAULTS AT CORNERS.

Curves, especially if they are geometrical (Fig. 3), are clearly more difficult to cut than straight lines, as the saw is being guided continuously in a circular direction. Curves of leaves (Fig. 4) are less troublesome, not so much because the actual line is easier to follow, but because a slip is less noticeable and may often be corrected. Circles or other curves which intersect (Fig. 5) are very troublesome to cut accurately, and their difficulties can only be overcome by watching very carefully the continuity of line.

Corners such as Fig. 6 are apt to be spoiled in three different ways : (1) By leaving the line too soon and rounding the angle, as Fig. 7 ; (2) by running past the

corner altogether and making an ugly detour, as Fig. 8 ; and (3) by leaving a small scar, as Fig. 9, as the saw is being turned.

Whenever possible, corners should be cut by approaching the angles from opposite directions, as indicated in Fig. 6. By so doing a clean cut is made. This, however, is not always practicable, and the worker must learn to turn correctly. The way to do this is to run the saw right to the point where the one line meets the other. Draw it back just about as much as its own thickness, keep the blade moving up and down, pressing it all the

FIG. 10.—EXPANDING JEWEL CASKET.
Designed by the Author. *Published by Handicrafts, Ltd.*

time against the *waste* wood, and slowly turn it till it faces in its new direction. The object of this is to make it ease itself in the waste wood.

The easing process just described prevents the breaking of saws at a corner, and also helps to prevent locking. The locking of the saw in the wood, indeed, is one of the initial difficulties of the handworker. It is usually the result of too much energy, a heavy pull causing the blade to stick fast in the grain. Sometimes it is the result of accidentally twisting the blade. Hard and gummy woods are apt to cause a lock which the worker himself cannot always avoid, but these woods he is not likely to encounter at first.

HINTS ON CUTTING

STRAIGHT LINES AND CURVES—FAULTY SAWS—PROJECTIONS — CORNERS — CIRCLES AND OVALS — DRAWING AN ELLIPSE—TIES—CONTINUITY OF LINE—PROTECTING DELICATE FEATURES—LARGE WORK—PLURAL CUTTING.

WHEN the first principles of fretcutting are understood the worker should make up his mind that everything he does shall be done well. And, as the first essential is to aim at accuracy in cutting, this chapter may be devoted to a few detailed hints which may be helpful.

Straight Lines and Larger Curves. — The outer border line of an article, if straight and unbroken, may be finished with the plane ; but occasionally we have fairly long straight interior lines to cut, and these are trying. Mechanical devices, such as temporarily screwing a metal straight-edge to the work are sometimes adopted, but the expert cutter usually prefers to trust to a steady hand and eye. Practice brings confidence, and when confidence is secured—that is, when we know we can do a thing in the right way—we rarely fail. What we have to remember is that nothing looks worse than a shaky, irregular line which is meant to be straight.

Long sweeping curves are even more important. These have originally been drawn with care in order to invest the design with a distinctive character. The general form of a photograph frame, for instance, may depend on long symmetrical curves, and if the sense of symmetry is destroyed, or if the sweep is broken by shaky irregularities, the spirit of the form will be lost. Before starting on any such curve the worker should have

a good look at it. It may start with a fairly sharp turn, then may flatten into a long sweep, and finally curve in quickly to some corner. The whole line should be well kept in view. Only in the case of circles or parts of circles is the line of curve the same throughout ; and, just as any other curve flattens or quickens according to its form, so each approaching variation should be anticipated. A good example of a design with long, unbroken curves will be seen on page 21.

Faulty Saws.—And here a word may be thrown in about one of those little grievances which have periodically to be encountered by every fretcutter. In time we learn to have a favourite saw-blade, but even then we find one which refuses to do as we desire. It may seem faultless, but for some reason or other it persistently cuts at an angle. What really is wrong is that the saw has a slight twist, and that, if we wish to cut a straight line, we have to hold the frame at a slight angle. One of three alternatives we may adopt. The simplest is to discard the saw, although this need not be done without some attempt at remedy. A second—and quite a common one—is to try and accustom ourselves to the crooked whim of the blade, and, in handling the frame, make allowance for the twist. The third alternative is to try to straighten the saw. This is often possible if the fault is slight. Fit the saw in the clamps, screw it up tightly, and with a pair of heavy flat-nosed pliers gently try to coax it straight. If the fault can be detected an attempted remedy is frequently successful.

Sometimes the kind of twist referred to is due, not to any flaw in the blade, but to some fault in the saw clamps. If this is so every blade will appear to be wrong, and it is idle to continue work until the clamps are put right or a new frame is procured.

Cutting Projections. — On every fret we meet with projecting points, some sharper and some flatter,

and with angles of all degrees. When these are encountered our aim must be to keep each sharp and clean. When we come to a point like A, Fig. 1, we can turn round in the ordinary way, but if we do this we may blunt the projection, and may also find a difficulty in getting correctly on to the next line. What in most cases is possible is to run the saw right past the point A into the waste wood and turn it as indicated by the

FIG. 1.—HOW TO CUT PROJECTIONS.

FIG. 2.—HOW SHARP ANGLES ARE CUT.

dotted line. In this way the blade leaves a sharp, clean-cut point at A ; besides which, in turning, we can direct the saw so that we have the line of the next curve in view. Particularly in treadle cutting, when the wood can quickly be turned, this plan should be adopted.

Corners are dealt with on a similar principle. The angle at Fig. 2, A, is a sharp one, not easily turned even with a fine blade ; nor, if we turn at A, is it easy to keep the portion of the curve at *z* exactly symmetrical with that at *x*. The workmanlike plan is to run the saw from B to A, then withdraw it to B, run it across to C, and

from C cut down to A. In this way we not only have a better chance of keeping the curve CA exactly like BA, but we leave a clean corner at A. In many cases the arrangement of the design makes this plan impossible, and openings (such as octagonal forms) with many angles have to be taken in the ordinary way ; but, in every case when curves spring from a sharp angle, or when a corner can conveniently be approached from opposite directions, the method indicated at Fig. 2 should be followed.

Circles and Ovals are among the most difficult forms to cut with perfect accuracy. Many overlays for photograph frames are either circular or oval, and if these are lighter in colour than the background they have to be taken with exceptional care. The first essential to accuracy is that our patterns are true. Each circle should be clearly described with a pair of compasses, and if the diagram of an oval is uncertain we should prepare a correct one.

The curve of a circle is regular throughout, and if we bear this in mind it helps us in cutting. No part of an ellipse is part of a circle, and—no matter what other people may advise or what some books on geometry may teach—an oval should never be drawn with compasses. However carefully we may try to set it out we leave " corners " which mar the finished cut.

Drawing an Ellipse is so simple that any schoolboy can do it accurately. Suppose we have to cut an oval 10 ins. long by 6 ins. wide. Take a piece of paper on a drawing board and rule the line AB, 10 ins. long. Halve this at X and draw the smaller diameter, CD, 6 ins. long, keeping CX and DX equal. Now measure half the longer diameter (AX) with the compasses or dividers, and, with C as the centre, mark the points P and P on the line AB. Thus CP is equal to AX—that is, equal to half of the longer diameter (5 ins.).

Take three pins and press them in at P, P and C. Round these tightly tie a piece of stout thread, making sure that the knot is firm. Withdraw the pin at C ; take a sharp-pointed pencil, place it within the thread, stretch the thread to its tightest and draw the oval on the paper. Keep the pencil vertical and the thread taut, and a correct ellipse will be the result.

This well-known device is very useful and is easily understood. CP equals half of the longer diameter and

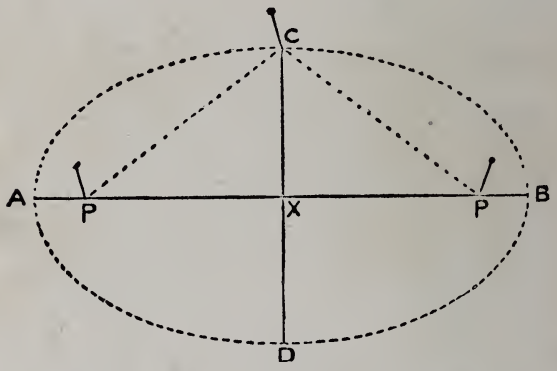

FIG. 3.—HOW TO DRAW AN ELLIPSE.

CX is half of the shorter one. Thus, when the thread is tied round the pins at P, P and C, and the C pin is withdrawn, the end of the thread reaches to A at one side and to C at the other ; and, as the thread is operated from a double centre (PP), the whole curve from A to C is correctly elliptical.

Ties.—The tie is such an obvious necessity in a fret that its use need hardly be explained. It binds the design together, and—according to the skill shown by the artist in using it—makes the fret strong or delicate, as the case may be.

The tie is necessary in fretwork for two principal reasons. Firstly, it is introduced for the purpose of keeping the whole thing together. A fretwork design not properly tied would fall to pieces when cut. In the second place, it is required to give strength to the ornament, and it is on this feature that we may offer a few suggestions.

The mere fact that the ornament *is* fretted means that it must, to a certain extent, be delicate—not necessarily fragile, but certainly much less strong than

FIG. 4.—THE TOUCHING TIE.

FIG. 5.—THE TANGENT TIE.

the solid board of wood. The strength or weakness depends partly on the character of the ornament itself and partly on the judicious distribution of ties which bind the ornamental features together. The worker is not responsible for the style of design, and has usually to cut just what is before him, but he is responsible for the strength or weakness that he gives to ties.

Ties may be divided into four classes. Firstly, we have the *touching tie*, as Fig. 4. Here the leaf seems to touch the border as if by accident, the ties giving it the needed strength without exaggerating or obscuring any feature. Secondly, there is the *tangent tie*, as Fig. 5. The curve of the ornament touches, but no more than touches, the

border. The straight line of the latter is not broken, nor is the character of the curve destroyed. Thirdly, we have the *constructional tie*, where, as in the case of A or B, Fig. 6, a little feature is deliberately added to connect the ornament. Fourthly, there is the *intersecting tie*, as Fig. 7, strength being obtained by lines which cross each other. There are endless variations of these ties, but the simple illustrations given are sufficient for our purpose here.

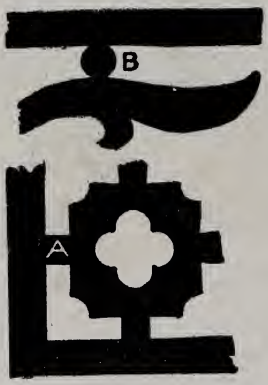

FIG. 6.—CONSTRUCTIONAL TIES (A AND B).

FIG. 7.—INTERSECTING TIES.

No tie should ever be regarded merely as a corner which has to be turned. It is not what is to be cut away that is important, but what is to be left. Two matters must have our consideration: (1) to preserve the characteristic forms of both adjoining parts, and (2) to make sure that the tie is kept strong enough without being too heavy. In the case of Fig. 4 the form of the leaf must be correct, and the lines it touches must be true. Again, with Fig. 5 the spirit of the scroll must be kept, whilst the line it just touches tangentially must be kept straight without the suspicion of a corner.

Constructional ties, as Fig. 6, have to be so negotiated that they do not mar the parts they connect, and in taking intersecting ties (Fig. 7) we have to keep an eye on the continued line beyond the angle we are approaching.

No fretcutter should ever allow himself to imagine that his work cannot be as good as the original design. So far as fretwork is concerned the saw can be as accurate as the pencil, and the constant aim should be to reproduce in wood all the spirit and accuracy of the original. This is no mere counsel of perfection. If accuracy is aimed

FIG. 8.—NOTE THE CONTINUITY OF STRAIGHT LINE, AB, AND OF CURVE, CD.

at from the beginning it eventually comes to be a mechanical habit ; whilst if the worker makes a point of studying each design beforehand and grasping the *spirit* of the ornament, he will soon acquire the similar habit of reproducing its distinctive characteristics.

Continuity of Line.—Straight lines and long unbroken curves have been referred to, but mention of ties will at once show that such lines cannot often be taken without unthreading and refitting the saw. They are continually broken by ties of different kinds, and the long line thus belongs to half a dozen openings instead of one. The lines AB and CD of Fig. 8 are cases in point. Before cutting, a straight-edge should be laid

along AB to ascertain that it is exactly straight, and the circular curve CD should be tested with compasses. Almost every interior opening of the design affects one or other of these two lines; and, when the worker approaches the border or the curve, he must not regard each little bit of line as something complete in itself, but must keep his eye along its whole length. AB and CD are not series of short lines linked together; each is one continuous line, only broken by necessary ties, and at each corner this sense of continuity should be remembered.

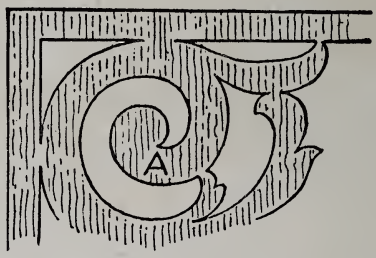

FIG. 9.—NOTE THAT THE NECK OF THE SPIRAL (A) IS DELICATE ON ACCOUNT OF THE SHORT GRAIN.

Protecting Delicate Features. — When cutting fine frets in thicknesses of $\frac{3}{16}$ in. or less there is sometimes a risk that the friction of the saw will cause a break against the short grain. This can be guarded against in two ways. If we take Fig. 9 we will notice a spiral lettered A. This will be no more delicate than any other part of the fret when cut, but, when sawing it, there is a strain on the neck. If the work is being held over the wide V opening of the cutting table, the fret will have no protection. It should therefore be pushed up so that the saw works within the little circular opening, the spiral part resting on the solid table whilst

it is being cut. In this way the delicate neck is protected from the friction of the saw stroke.

Fig. 10 gives another instance where protection can be given. The fret is from a piece of old Scottish woodwork, but will serve as an illustration. Note the opening lettered X, and assume that we have started at A and sawn to B, and then round to C. Now, as we work from C round to A, the loose waste wood is hanging to the small terminal spiral, and the vibration may cause a split. If we protect the spiral by resting it well on

FIG. 10.—WHEN CUTTING THE SPIRAL (C), DO NOT LET A HEAVY PIECE OF WASTE WOOD HANG TO THE DELICATE NECK.

the cutting table nothing may happen. But a far better plan is first to cut from A to C ; in this way the delicate part is at once freed from the waste wood, and we may saw from C to B and from B back to A without running any risk.

Numerous similar examples could be given, but the safe general rule is never, during cutting, to let a heavy piece of waste wood hang to a delicate part. Free the delicate portion first, and then proceed to take the rest of the opening. When removing the loose piece take care that it falls out straight ; otherwise it may jam on some delicate neck, and if force is used a break may ensue.

Large Work and Small Frames.—Saw frames of 12 ins. or 14 ins. have an advantage over those of larger size as they are more easily brought under control. When, however, the work in hand is over 12 ins. or 14 ins. long, the sawing of the end portions has to be negotiated in order that the wood will clear the end of the frame. Lest some younger reader may imagine that he cannot cut work longer than his frame, the method of overcoming the difficulty—fairly obvious—may be mentioned.

Take Fig. 11, which may be about 15 ins. long. With a 12-in. or 14-in. frame we have no trouble with any

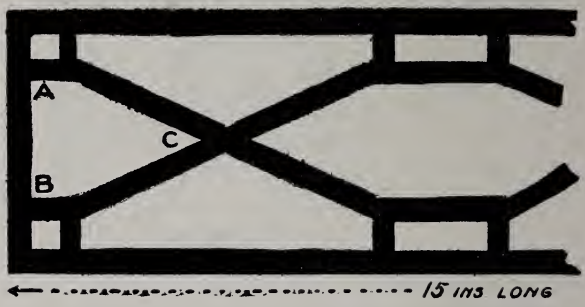

FIG. 11.—CUTTING LONG WORK WITH A SHORT FRAME.

of the openings till we come to the end ones. If a start is made at A and the saw run to C, the frame cannot be turned round to take the next cut because the end arm will be blocked by the work. What we have to do is simply to draw the blade back to A, and from there go round to C by way of B. When the work in hand is much larger than the frame, and there are many interior openings, the cutting gets a little tedious, but no difficulties which cannot be surmounted are presented.

PLURAL CUTTING.

Plural Cutting means cutting two or more boards of wood at once. The boards are firmly nailed together,

the pattern pasted or traced to the upper one, and the cutting then done in the usual way. When the work is completed and the boards separated the duplicate frets are revealed.

Plural cutting is adopted for one or more of three reasons :—Firstly, to save time and the additional trouble of drilling and sawing ; secondly, to avoid tracing or the purchase of a second design when only one diagram (of which two or more are required) of a particular section is given on the pattern sheet ; thirdly, to increase the thickness of wood when very thin overlay boards are being cut. (This last consideration will be dealt with in the chapter on Overlaying.)

As against these advantages two difficulties may be mentioned—one obvious, the other not sufficiently realised. One is the heavy sawing, owing to the increased thickness ; the other is the uncertainty of maintaining a vertical stroke, without which the under fret will have the appearance of being badly cut.

In spite of these apparent disadvantages, however, plural cutting should be adopted whenever possible. The time saved in avoiding double pasting down, double drilling, and the double unthreading and rethreading of the saw more than compensates for extra labour otherwise.

The treadle worker can, of course, do plural cutting with much greater ease than the man who has only a hand frame to use. In treadle sawing, if the machine arms can be relied on for rigidity, if the table can be kept exactly at right-angles to the saw, if the blade is adjusted to a high tension, and if the worker does not object to comparatively slow progress, he can cut up to about the full thickness which the distance between table and upper saw clamp permits.

The hand worker has to be guided partly by the hardness of the wood he is using. As a rule he need not hesitate to cut $\frac{3}{16}$-in. boards in double thickness, especially if the diagram is a small one.

The Pattern.—With regard to laying the pattern on the wood for plural cutting, a preliminary hint may be thrown out. Fig. 12 represents duplicate parts of a design. If two rectangular boards are cut and nailed together, and a diagram is pasted on the upper one, it will be seen that a large corner of waste wood will be cut away from each piece. This needless waste may be avoided if the diagram is first loosely placed on a piece of wood, as shown. The line AB is then cut with the saw and the two parts nailed together. By so doing, several inches of good wood are saved. If both patterns

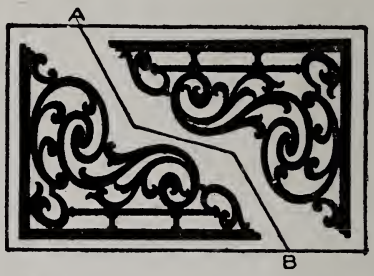

FIG. 12.—ARRANGING DIAGRAM FOR PLURAL CUTTING.

were to be cut separately the arrangement of the diagrams is the obvious one ; but in plural cutting the obvious is very apt to be overlooked. (For the sake of clearance, the illustration shows two diagrams; in plural cutting there would only be one diagram.)

Cutting.—When the pattern has been pasted down or otherwise transferred the two pieces of wood must be firmly nailed together so that the friction of the saw may not cause them to vibrate during cutting. The nails are driven into some of the interior parts which are to be cut away, and when sawing is commenced these openings must be left till the last. A few nails should also be driven in outside the outline. When cutting is

begun it is impossible to exaggerate the importance of both an even and a vertical stroke. It must be remembered that the undermost surface is about half an inch below the uppermost, and that the only way to keep the line of the lower fret exactly the same as the pattern line above which is being followed is to maintain the absolute verticality of the blade, and to steer clear of any irregularity in the stroke which would leave saw-ridges on the edges.

Separating.—A large central opening, well nailed, should be left till the end. As this is sawn the pieces of wood begin to come apart, and must be held together tightly while the separating cut is made.

In plural cutting the lower surface is usually rough, and requires a good deal of glass-papering. The inner surfaces, on the other hand, will show little roughness if the woods have been firmly fixed together. It is not often that both sides of a fret are equally prominent on the finished article; thus, when the two pieces are separated (as, for example, in Fig. 12) the inner surfaces —one right hand, and the other left—should be the ones chosen for most prominence. When both sides of a corner bracket are sawn together it is customary to let the inner surfaces be those which will afterwards be seen. They are smoother, and require less glass-papering than the outer surfaces.

JAPANESE PANEL PHOTOGRAPH FRAME (OVERLAID).

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CUTTING IN RELATION TO STYLE

STYLE AND CUTTING—FIGURES, ANIMALS AND BIRDS—LETTERING—CHARACTERISTIC STYLES.

AS experience is gained, the worker usually finds himself drawn towards designs of the more artistic type. These are not necessarily large or elaborate designs, but rather ones which are characterised by a distinctive style. They may have less fretting on them, but they call for more care in cutting. The beginner has a curious tendency to avoid patterns

FIG. 1.
FLOWER FORM. NOTE *a a* AND *c c*.

FIG. 2.
NOTE BAD CUTTING AT *b* AND *d*.

FIG. 3.
SCROLL FORM. NOTE THE CURVE AT *e*.

which err on the plain or severe side, and plunges into work which is florid and intricate. Later (and especially if skill in cutting is attained) he realises the advantages of occasional plain grounds, which lend repose to the design; whilst, as he gets accustomed to criticise his finished work, he finds that touches of severity lend to an

object a sense of dignity which seems lacking in those which are mere works of intricate fretting.

Style and Cutting.—Although it is not necessary for a fretcutter (who works from a printed pattern) to make a careful study of the various styles, he should always carefully study the character of every design he cuts. In this way he follows the idea of the artist and grasps the spirit of the ornament. Cutting, after all, is a good deal more than slavishly following the pattern line. It is entering into the spirit of the ornament and reproducing what is intended to be conveyed.

Look, for example, at Fig. 1, and note the little turns at *a a*. Note also how the bulb of the floral form takes a slight bend upwards at *c c*. Now glance at Fig. 2, where *b b* and *d d* indicate that these features have been neglected, and that the spirited form of Fig. 1 has thus been partly lost.

Or take Fig. 3, which shows a form frequently met with in rococo Chippendale ornament. Here everything depends on the way that the little hair line *e* is taken; and unless the character of the terminal is understood, the saw may fail to reproduce the original. Numerous examples could be given, but these explain what may be called cutting with intelligence and spirit.

Figures, Animals, etc.—On many designs we have figures, animals, birds or butterflies. These, of course, can only be shown satisfactorily in silhouette, and the greatest care should be taken to study every feature of the outline. When the form has to be emphasised with an endless number of fine interior hair lines, this is a fault in design. A few such lines, accessible from some interior part which can easily be drilled are permissible, but those for which satisfactory drilling is impracticable are a blemish.

Interior hair lines weaken a fret, and if they are numerous it is a wise precaution to force a little warm

FIG. 4.—FRETTED PANEL WITH THE LORD'S PRAYER. NOTE THE THREE KINDS OF LETTERING: (1) PIERCED (AS "KINGDOM"); (2) SOLID, WITH PIERCED BACKGROUND (AS "OUR FATHER"); (3) OVERLAID IN SCROLLS (AS "THY WILL BE DONE," ETC.).

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glue into them. In this way the fret may be rendered less fragile.

Lettering in designs can hardly be said to differ from other fretted features, but on account of the prominence it has lettering usually calls for special care. Lettering is introduced in three ways: (1) where the letters are

FIG. 5.—PIERCED LETTERS.

FIG. 6.—SOLID LETTERS WITH OPEN BACKGROUND.

FIG. 7.—OVERLAID SCROLL WITH LETTERING.

pierced, as Fig. 5; (2) where the background is pierced and the letters are solid, as Fig. 6; and (3) where the letters, detached or enclosed within a scroll, are overlaid on a solid background, as Fig. 7. See also Fig. 4.

Pierced letters are in the nature of stencils, and letters such as B, O, R, etc., thus require ties. When the background is cut away, the cutting calls for patience, as each opening affects more than one letter, and the continuity of the boundary lines requires to be closely

watched. Overlaid letters also need skilful cutting and fitting, as any defect will be readily noticed. The particular style of letter used should be noted in every case.

Characteristic Styles.—Patterns which are designed in a characteristic style are always interesting, although it must not be taken for granted that designs specified as "Chippendale" or "Japanese" or "Indian" are always true to their titles either in general form or in detail.

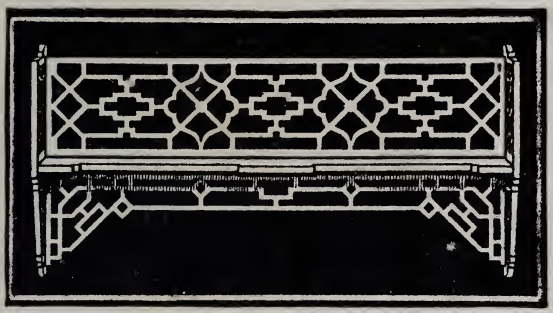


FIG. 8.—CHIPPENDALE SHELF. SIZE, 17 INS. BY 8½ INS.

English styles which lend themselves to fretwork treatment are Tudor (or Elizabethan) and Chippendale, whilst the Adam and Sheraton styles are found in inlaid work, and occasionally in overlays. Chippendale ornament is of two distinct types. Firstly we have the severe frets made up largely of straight lines (see page 161), and secondly the more florid "rococo" style borrowed from the Chinese. French ornament of the Louis XIV. and XV. periods is sometimes introduced, and adaptations of the Italian Renaissance acanthus leaf are frequent. Dutch, Celtic and Scandinavian patterns are rarer, but the Eastern styles have always been favourites. The

FIG. 9.—OVERLAID ORNAMENT SUITABLE FOR A CASKET FRONT.

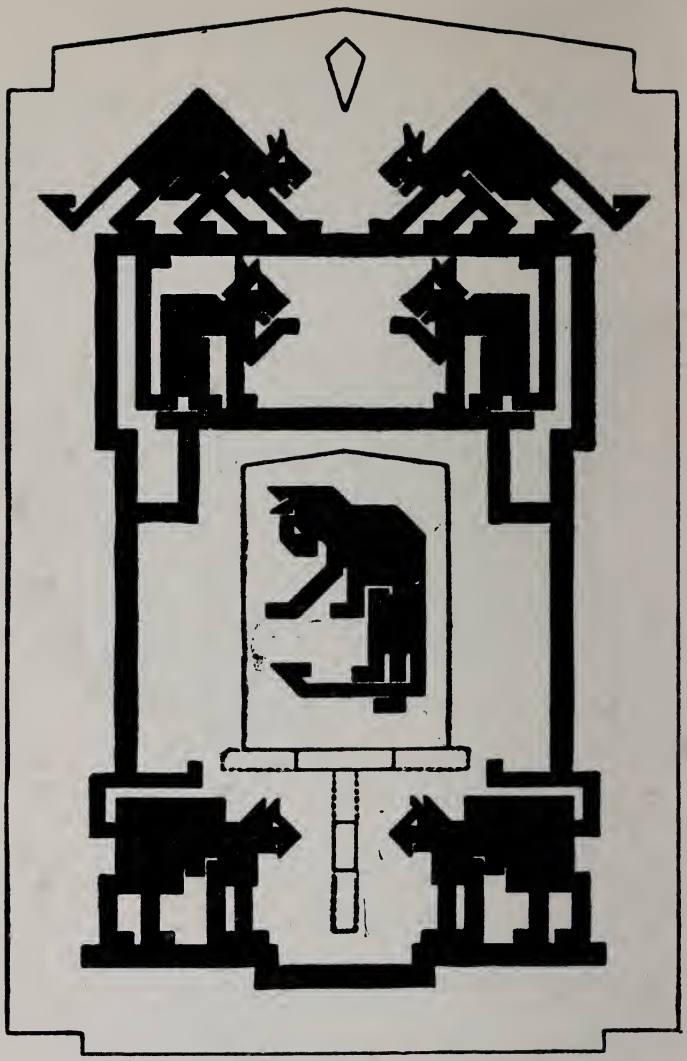
most popular of these latter is Japanese, although so-called "Japanese" designs are not always free from inaccuracies which are obvious to an artist. Indian ornament adapts itself beautifully to fretwork, and very effective work can be done in the Arabian, Moresque and Persian styles. In addition to these the curves of more

FIG. 10.—ARABIAN WORKBOX.

Designed by the Author. *Published by Handicrafts, Ltd.*

modern art have now a prominent place in published designs.

It is unnecessary to enter minutely into the characteristics of these many different styles. A few examples are given for guidance, and others are illustrated elsewhere in the volume. It must be borne in mind that many designs may be exquisite in their artistic grace, although it may not be possible to designate their style by any country or period.



A GROTESQUE CAT FRET. NOTE THE ABSENCE OF CURVES, THE EFFECT BEING OBTAINED BY STRAIGHT AND ANGULAR LINES.

TREADLE FRETSAWING

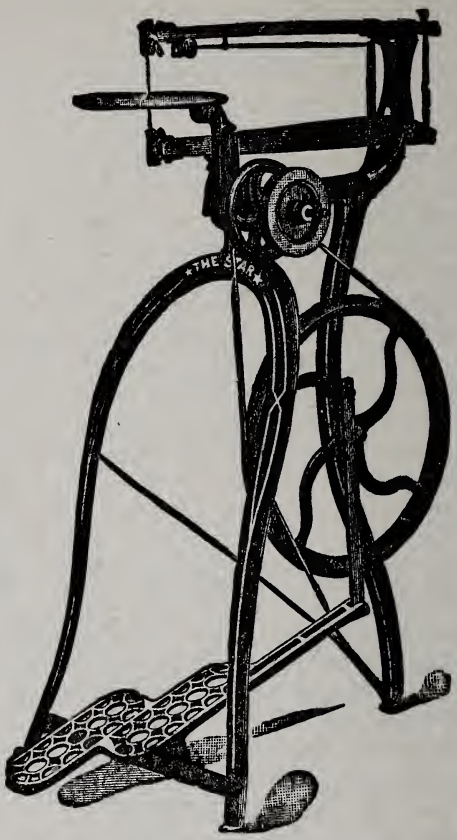
ADVANTAGES OF THE TREADLE SAW—HINTS ON TREADLE CUTTING—THE CARE OF TREADLE SAWS—BEVELLING.

THE TREADLE FRETSAWER is not necessarily a more skilled cutter than the hand worker, but he rejoices in several advantages. These are chiefly: (1) He has more freedom, (2) he can cut more quickly and more easily, (3) he has better facilities for plural cutting, for sawing thicker woods and for cutting metals, and (4) he can undertake inlay work with far more ease than he could with a hand frame.

The extent of these advantages depends to some extent on the type of treadle fretsaw he possesses. A more costly one is better equipped than one of cheaper make, but even the least expensive offers the advantages mentioned.

No reader must imagine, however, that his work is going to be better simply because he has a treadle saw. He has, doubtless, better opportunities for doing more and better work, but no machine will relieve him of the necessity for that care which is essential in all woodwork. Many expert cutters, indeed, who began with a hand frame return to this tool when they wish to do a particularly fine bit of work, feeling no doubt that slower progress ensures greater accuracy.

Advantages of the Treadle Saw.—The first advantage that the worker experiences when he has secured a treadle saw is that both hands are free to control the work. As the machine is operated by the feet, he is relieved of all hand work except holding the wood and feeding it to the saw. This relief is felt in two directions—the strain on the right arm is removed, and



TREADLE FRETSAW OF INEXPENSIVE TYPE.

there are two hands to do the work which formerly was done by one.

That the saw can be driven at a far higher speed is obvious. This may be a drawback in the case of thin or soft woods, as the worker is then apt to lose control of his machine, but with heavier work it is a distinct advantage. That work is easier is also clear. The saw runs steadily almost without effort, and the cutter is free to concentrate all his attention on his work.

Then the treadle and driving wheel combine to place more power behind the saw, and in this way heavier material can be sawn with as much ease as a $\frac{1}{4}$-in. board can be cut with a hand frame. Plural cutting becomes comparatively simple, and although metal work is always heavy, the treadle saw greatly reduces the labour.

Inlaying is dealt with later, but it may just here be said that, for inlay work in the solid, the cutting table of the machine gives opportunities for sawing on the bevel which cannot be had in hand work. This advantage will also be experienced when inlaid underlays are used.

Hints on Treadle Cutting.—In treadle fretsawing the saw is not guided to the line, but the work is fed up to the saw. The saw faces the cutter, whereas in hand work it faces away from him. The wood has to be held firmly on the table, otherwise the friction of the saw will jerk it upwards. There is no difficulty in guiding, but with some woods it will be found that the saw cuts far more quickly across the grain than with it, and this has to be watched.

Of the actual treadling little need be said. What should be aimed at is smooth work. Keep the right foot a little forward and the left foot a little back, and use only the minimum of pressure. Pressure with the right foot brings down the pitman of the driving wheel, and when this pressure is relaxed the left foot drives the

pitman upwards. What a little experience soon brings is the knack of exerting and relaxing the pressure of each foot at the right moment so that the pitman never jams at the top or bottom turn.

In treadle cutting we have the problem of the vertical stroke just as in hand work. If the cutting table is not at right angles to the saw the stroke will be off the vertical, and sometimes a faulty adjustment of the arms will produce the same result. The saw may periodically be tested with a set square, but if at any time it is tried on a thick piece of wood its accuracy may be ascertained. The habit of using a spirit level to test the cutting table is, of course, useless. What is wanted is that the saw is at right angles to the table, and this may be correct no matter how uneven the floor on which the machine stands may be.

Control of the Saw is as essential in treadle cutting as in hand sawing. The rate of actual cutting is determined not so much by the speed at which the machine is run, but by the pressure applied to the wood in feeding it to the saw. When thin or soft wood is on the table, skill is required to so hold the board that the saw will be wholly under the worker's control. With thick or hard wood, control is apt to be lost in other ways, chiefly by the saw getting locked in the wood. What in this case has to be aimed at is to exercise such degree of pressure that the blade will cut steadily (though slowly) without locking.

A corner is dealt with in the same way as in hand cutting. When the saw reaches the angle it is kept running, though not actually cutting, while the wood is turned. The speed is slightly diminished, and the teeth of the saw ease themselves in the waste.

Care must always be taken not to let any fragile pieces of wood be broken off by the friction of the saw. The risk is incurred partly by the dragging action of the saw and partly owing to the size of aperture in the tilting

table. If the hole in the table is very small the danger is slight, as the fragile frets have ample support; but some tables are provided with holes which are exceptionally large, and if the delicate part of the fret is smaller than the hole it runs a chance of getting broken. The danger is avoided by working with as little friction as possible, and also by so cutting that a heavy piece of waste wood is never left hanging to a fragile fret.

At first, guiding may be found more difficult with the treadle saw than with the hand frame. The reason is that, in the former case, the wood only can be handled, whereas in the latter case both saw and wood are mutually guided to each other. It is largely a matter of practice, and when the machine is absolutely under control much depends on the ambitions of the worker himself—that is, on his ideas of what correct cutting really is, and on his desire to reach perfection. Some workers are never satisfied until their work is practically flawless; others remain satisfied with the most humble degree of skill.

The Care of Treadle Saws.—Any treadle saw may, at some time or other, give trouble, and the best way to avoid needless trouble is to take care of the machine.

It should be kept well oiled, and, as it is impossible to prevent the accumulation of sawdust, the running parts should periodically be well cleaned. At first the driving belt may be stiff, but after a little working it will slacken. When, later, it gets too slack, remove the clip, cut off a short piece of the leather and rejoin.

Every treadle worker should study his machine. He should note how the different parts are fitted and how the working parts are operated. Two fairly common grievances are (1) that the saw shows signs of side-play, and (2) that, for some reason or other, we have to hold the wood at an angle in order to cut straight.

By side-play is meant that the saw, at the top of its stroke, may be at one side of the opening in the tilting table, and at the other side when it comes to the bottom

of its stroke. If we know our machine we can put the matter right. All that may be necessary is a slight adjustment of the saw clamps; one or other may be too far forward or too far back, or a clamp may have slipped to one side. Or, if the treadle saw has a wooden arm, the screw which holds it may be too tight or too slack, or the fault may lie at the disc which operates the lower arm. A few tests should in any case locate the seat of trouble.

If the saw does not cut straight, the saw itself may be twisted, and this can be tested by trying another. Or the trouble may again lie with the clamps, and if these are removed and readjusted the trouble may disappear. Sometimes it happens that a wayward saw-blade only requires an extra turn of the tension screw to set it again in the straight path.

The screws of saw clamps give way in course of time, and, rather than risk a more frequent breakage of blades, it is better to buy a new pair.

Bevelling with the plane and shooting board is dealt with later, but by means of the tilting table, bevelled edges can easily be cut on the edges of shelves, table-tops, etc. If the edges are straight, the work can be done more accurately with a plane; but, when they are shaped, the cutting table may be tilted to the required angle and the edge sawn.

GLASS-PAPERING

REMOVING THE PATTERN—THE FILE—THE GLASS-PAPERING BLOCK—CLEANING EDGES—FINISHING

IF the pattern has been traced by means of black or red carbon paper, the worker proceeds direct to the operation of glass-papering. If he has pasted down the diagram he has first to remove the paper from those parts of the wood which have been left uncut.

Removing the Pattern.—It has previously been said that paste, and not glue, should be used for applying the pattern. Glue penetrates into the pores of the wood and drags the paper with it. Pasted paper is much more easily taken off. Any one knows, of course, that if the paper is moistened and allowed to stand for ten minutes or so, the paper will peel off quite readily. This, however, is an unwise plan for two reasons. Dampness is apt to cause the wood to swell for the time being, and when it dries the work is very liable to warp or twist. In this respect, too, there is often more danger when the wood is fretted, or partly fretted, than when the board is solid. The second danger is that the moisture finds its way on to the cut edges of the wood, where it will cause the grain to rise and present an ugly woolly appearance.

Unless the paste has been exceptionally strong, it will be found that a considerable portion of the paper can be peeled off with the fingers. A little judicious coaxing with a sharp penknife here and there will remove a good deal more. What remains should be taken off with glass-paper. Here, however, the worker should not use fine glass-paper; this is too smooth, and has a tendency to rub the paper into the wood. Coarse paper must on no account be used, but if medium paper is taken it will

be found effective in its results. Whenever the paper loosens it should be torn away ; for the rest, the glass-paper will soon do its work.

Directions for glass-papering will follow. Here it may just be said (1) that any glass-papering (even when it is only a question of the paper being removed) should be done with the grain of the wood ; and (2) that all glass-papering must be done gently, though firmly, the greatest care being taken not to break off any projecting or otherwise delicate parts of the fret.

It might be added that some workers scrape off their patterns with a sharp steel scraper, a tool that must obviously be used with great care. Others employ damping in one of the following ways : (1) by lightly moistening the paper with a little water on a camel-hair brush, care being taken not to go over the edge ; or (2) by wetting a sheet of clean white blotting paper, laying this flat on the table and placing the work (diagram side down) on this. In either case the paper will peel off without much risk of the wood warping.

The File. — A word may be said about the file, although its use is not recommended except in special cases of emergency. Many workers never even keep a file (that is, a wood file) in their tool box, and if they use one at all it is only for metalwork. The habit of using a file to correct mistakes in cutting should be avoided. The fret itself should be finished to perfection, so far as possible, by the saw, and work should never be scamped with the view of afterwards remedying it with the file. Thus, any reference to the file here is only in connection with incidental matters.

A set of six fretwork files does not cost much, and at times these may be of service. It may sometimes happen, for instance, that in cutting a circle a little ridge may be left where the saw completes its round. Again, a corner may just miss its sharpness, or a tiny circular hole may just fail to appear quite round. Then it may

often happen that stubborn threads of grain may cling to narrow openings which cannot easily be reached by the ordinary glass-papering process. In all these cases a file may be safely and satisfactorily used. Fretwork files are supplied in various sections : square-edged, for square corners ; triangular, for more acute angles ; oval and semi-circular, for other kinds of angles formed by curved lines ; flat, for straight lines or flat curves ; and circular, for finer curves, circles, etc.

If the file is used at all it must be employed with care. It has to be held vertical like the saw, and must be worked with a smooth and regular stroke. Any carelessness will simply result in rounded edges and ugly ridges.

Glass-papering.—Between the cutting of the frets and the fitting up of the article being made comes the intermediate operation of glass-papering. On this two general observations may be made : firstly, it is of vital importance ; secondly, it is rather slow work which calls for patience.

If, however, glass-papering is found tedious (as it is by some) this is chiefly because the worker has failed to get it into his head that this is part of the actual work. He looks on glass-papering as an incidental extra which he had not calculated upon, and which he discovers to be far more laborious than ever he had imagined. In actual practice glass-papering is less tedious than sawing, and when the worker realises the enhanced effect of a well-finished fret he will be no more likely to groan at the labour of glass-papering than he does at the effort of sawing.

Unless rough, unplaned wood direct from the mill is used, the worker never requires to use coarse paper. Indeed, he is better not even to stock it, as coarse paper only scratches and spoils a smooth surface. Different grades of paper are wanted for different woods. What the worker should begin with are a sheet of medium paper and fine and flour glass-paper. He will soon learn

by experience which are the most suitable papers for different purposes. New sheets are, of course, stronger than worn paper, but well-worn pieces should be preserved, as they are often useful for giving a dull finish to certain woods. Sheets which are wanted for white woods should be kept exclusively for such, as glass-paper which has been used on a dark wood is apt to soil a white board.

So far as fretwork is concerned, there are three stages in glass-papering : (1) the preliminary cleaning, including the removal of the diagram, (2) the clearing of the edges, and (3) the final smoothing.

When a fret has been cut it presents the following appearance : The edges, seen from the upper side, seem fairly smooth, as the surface has been protected by the paper. The under surface, however, looks very rough, the teeth of the saw (cutting downwards as they do) having dragged the grain and left ragged threads hanging from the edges. This under side, too, will probably be soiled. If the diagram has been traced, and not pasted, the upper surface will also be soiled. An examination of the cut edges will show that many of these have threads clinging to them. Where the saw has cut across the grain the edges will be smooth, but where it has cut along the grain a certain woolliness will be in evidence. The extent of the raggedness all round depends partly on the nature of the wood, partly on the size of saw-blade used, and partly on the method of cutting. Open-grained woods show more threads than close-grained ones, as the saw does not cut so cleanly through them. Then a fine blade naturally cuts more smoothly than a coarser one, whilst it is clear that a quiet, even, regular stroke gives a less ragged result than a series of heavy pulls.

If the piece of wood dealt with is small (say, 6 ins. or 8 ins. in length), the simplest plan is to lay the glass-paper flat on the table and rub the wood upon it. Keep

the fingers well over the whole surface, so that the pressure is uniform, and rub carefully *with* the grain. Rub slowly at first till the paper seems to grip, then gradually increase the pressure and rub more briskly. The delicate character of the fret must never be overlooked, and the worker must particularly watch to see that a fragile part does not catch on an upturned corner of the paper and break. Another point to watch is that the wood is held quite flat. If raised at all it means that one end or corner of the wood will get thinned down.

The Glass-papering Block.—When the work is large (say, from 12 ins. to 18 ins. in length, and 8 ins. or 10 ins. wide), the glass-paper is wrapped round a wood block or cork pad. Carpenters and cabinet-makers use special cork pads for the purpose, but excellent glass-papering blocks, specially made for fretwork purposes, can be bought cheaply. It is a most undesirable practice to hold the glass-paper in the hand and rub it direct on the wood. The fingers in such a case are apt to press into the openings, with the result that the edges get slightly rounded. Any rounding of the sort must be carefully guarded against. It ought to be said, too, that if the wood appears to be scratched the worker should search for the cause of offence, which will be found in the form of an extra large grain of glass. This should be removed.

Edges.—When both sides have been thoroughly glass-papered the edges want attention. Some of the ragged threads will already have been removed, but still many of the interior edges will be rough or woolly. All these must be cleaned. In some cases the file may be requisitioned ; in others a thin strip of glass-paper may be cut, folded once, and used in the same way as a file. What the reader must understand is that he should not leave the work until every thread is taken away. In some cases the threads are really surface ones which

have got folded inside. These have to be coaxed into the open and then glass-papered off from the surface.

It is impossible to exaggerate the importance of this cleaning operation. It is the point where hundreds of even expert cutters fail, and its value as a step towards perfection ought to be grasped from the outset. It is a good plan to take a fairly stiff brush and gently brush out each opening. This not only clears away the sawdust which clings to the corners, but also forces out some additional threads of grain which had got overlooked. A little gentle tapping all over the wood will also help to get rid of any remaining dust which has gathered in sharp angles.

The Final Stage is to finish with glass-paper so as to get a smooth and glossy surface. And here it may be said at once that, although the back is originally rougher than the front, it should be finished to the same degree of smoothness. In the case of wall ornaments, such as brackets, the back of the article is not seen ; but in other cases both sides are equally important, and the worker should early accustom himself to finish both surfaces to an equal degree of fineness.

The grade of glass-paper used for the final rubbing depends partly on the wood used and partly as to what finish in the way of oiling or polishing is to be given to the article. Many woods—white maple, for example—take on a natural dull polish by rubbing up with well-worn, fine glass-paper.

Some workers adopt the practice of cleaning out each hole as they cut it. While this is not necessarily any saving of time, it varies the work by giving a rest from cutting and avoiding the long time spent on glass-papering later on.

The glass-papering of overlays will be spoken of later on. A hint as to the treatment of fragile work may, however, be thrown out. When a fret is delicate in its outline, the outer waste wood from which it has been

cut should be preserved entire. The fret may then be placed within this for glass-papering. If the interior parts are also fragile, some of the larger waste pieces may be kept and placed back in position while the wood is being rubbed. In this way there is little danger of any accident.

LARGE INDIAN BIRD-CAGE.

Designed by the Author. *Published by Handicrafts, Ltd.*

JOINTS AND FITTING

MORTISE AND TENON JOINT—HALVED JOINT—LOCKING JOINT—WEDGE JOINT—DOWELLING—BATTENS—MISCELLANEOUS JOINTS (BUTTING, REBATED, MITRED, DOVETAIL, ETC.)—THE SHOOTING BOARD

MANY skilled fretcutters are men who earn their living as cabinet-makers, carpenters or mechanics in other trades, and who have taken up fretwork as a pastime for spare hours. Their training is such that they fall naturally into all methods of fixing, and many of them excel in fitting rather than cutting. The amateur, on the other hand, has usually to learn fitting for himself, and while he often excels in cutting he shows a lesser degree of skill in construction. Many professional woodworkers are as expert at cutting as in fitting, and some amateurs display a skill in fitting that the cabinet-maker might envy; but, as a rule, it is the amateur who requires to be warned that the constructional part of the work needs as much thought and care as the task of sawing.

In the case of many fretwork ornaments the simplest of woodwork joints are used. There is rarely much strain on the thin wood used, and the more difficult joints which the cabinet-maker and carpenter use every day are not employed. It is a great advantage to have a knowledge of, say, mitreing, rebating and dovetail-grooving, but even the largest printed designs are shown with simple joints. Indeed, one reason for the continued popularity of fretwork is that, on designs, the method of construction is indicated, and even the least experienced amateur can make up the article himself. The cabinet-maker who uses these designs is under no compulsion

to adhere to the simple joints shown, but may employ his chisels for introducing something more durable. For the simpler fretwork joints chisels are not required; the saw alone does the work.

The Mortise and Tenon Joint is the most frequently used. It is employed in its simplest form, and the tenon is invariably cut to go right through. Shouldered tenons are never used, nor is wedging ever required. In many cases, indeed, the mortise and tenon

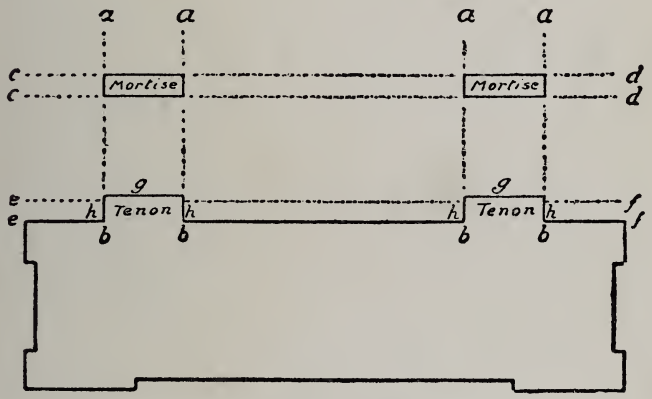


FIG. 1.—BRACKET SHELF WITH TENON JOINTS.

joint might be dispensed with, and the work held with screws. On the pattern sheet it is convenient to show the joint, as it indicates the correct positions of the parts concerned.

If we take Fig. 1 as representing a shelf, to be tenoned to the part bracket back shown, we find two tenons cut to enter their corresponding mortises. The wood used we may suppose is $\frac{1}{4}$ in. thick. Four matters for consideration will at once strike the more skilled worker: (1) that the positions of tenons and mortises must exactly correspond; (2) that the width of the mortise

must correspond with the thickness of wood used—that is, $\frac{1}{4}$ in.; (3) that the depth of the tenon must be a full $\frac{1}{4}$ in., so that it may be flush with the back surface; and (4) that the cutting generally must be accurate.

(1) We must not treat tenons as ordinary features in the outline of the diagram, and mortises as if they were ordinary interior spaces. In one sense they are, but they are much more. However carefully a design is printed there is always the chance of some slight slip, and joints should never be cut until they have been very carefully tested. To ensure accuracy, the lines *a b*, *a b* should be drawn in pencil in order to make sure that the relative positions of tenons and mortises are correct. It is only in this way that perfect accuracy can be secured.

(2) Then it is clear that, if a close fit is to be had, the width of the mortise must be just equal to—or, rather, a shade less than—the thickness of the wood. Thicknesses have a tendency to vary, and the width of the mortise shown on the pattern should never be taken as being absolutely correct. It must be remembered, too, that glass-papering will reduce that thickness to an appreciable extent. Thus, when the lines *c d*, *c d* are ruled, the width between them should be slightly *less* than $\frac{1}{4}$ in. If the mortise, when cut, is too wide, remedy is difficult; if it turns out to be too tight, it is not a difficult matter to reduce the thickness of the tenon by a little careful glass-papering.

(3) In the case of the tenons, the thickness of the wood should also be indicated by drawing the lines *e f*, *e f*. Here, however, it is a mistake to cut off the tenons themselves flush with the line. It is better to cut them about $\frac{1}{32}$ in. deeper, as indicated at *g*. The object in this is to ensure their coming right through the mortise. The slight projections are afterwards flushed down with glass-paper, and in this way a more workmanlike effect is secured. It is a wise plan, too, in cutting the ends, *h h*, of the tenon to leave these a little full, so

that some pressure will be required to coax the tenon into its mortise. A tight fit is essential, and it is always easier to pare down a tenon if it is too large than lengthen it if too small.

(4) In actual cutting the ordinary rules of accuracy have to be observed. Lines have to be straight, and corners must be square and sharp. The lines *a b*, *c d* and *e f* will afford an extra guide, and it is important to watch the continuity of line. In cutting the tenons it must be noted that the lower of the two lines *e f* is continuous and straight. Any fault here will result in the shelf not resting flush on the back.

To sum up, what the worker has to note are that when the rack is fitted in position no daylight is visible at any part, and that at the back there are no gaping joints. At the first few trials it may be found difficult to secure accuracy, but perfect accuracy should always be aimed at, and after some experience the worker gets mechanically into the way of doing things correctly.

If, through some slip, a gap appears at the back, the simplest way to remedy it is to cut a little wedge of wood, glue it and force it into the opening. When the glue has set, it may be glass-papered flush. It is well, however, to avoid all such gaps, and this can be done by following the simple directions given.

As a rule, it is well to cut tenons and slots before the ornamental part of the work is tackled. The wood is then solid, and if any adjustment is necessary it is easier to do it at this stage than when the article is more fragile with the fretting.

The Halved Joint is well known in carpentry and in ironwork, but, on account of its combined simplicity and effectiveness, is a constructive feature perhaps more widely used in fretwork than in any other handcraft. There are two general uses to which it is put. Fretwork boxes or box-shaped ornaments, for example, are not usually finished square at the corners and

mitred. Sides are allowed to cross, the overlapping being effected by means of slots cut as at Fig. 2. The slots are the exact thickness of the wood in width, and as one is cut in the upper half of the first piece of wood, the other in the lower half of the second piece, the woods cross, leaving two projecting parts at the corners. When these parts are fretted they form features of the ornament.

The second principal use which the half-cut joint has

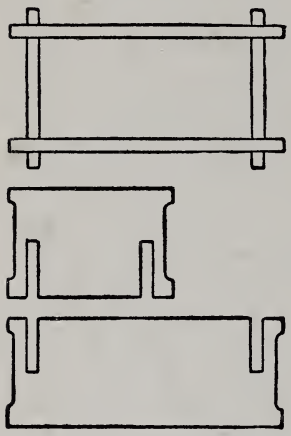


FIG. 2.—HALVED JOINT FOR BOX SIDES.

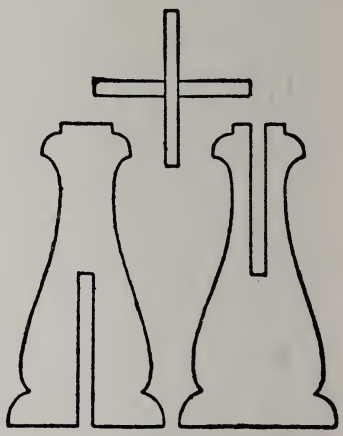


FIG. 3.—HALVED CENTRAL JOINT.

is to furnish a strong and effective central joint. A stand, for instance, is made of two parts, which cross at the centre by means of the halved joint seen at Fig. 3. In plan the united pieces form a four-legged ornament as shown.

The term "halved" simply means that each slot is cut just half-way through the wood. The two parts slide into each other, each gripping its neighbour. The joint is practically a self-acting one, and if the slots are so cut that they hold the wood tightly, even the use of

glue is often unnecessary. Parts like Fig. 3 have usually a base or ledge to which they are tenoned. Box sides, again, are fixed to a bottom, and are thus held secure.

In more incidental ways the halved joint is a favourite method of fixture. Box toes are frequently made of two parts which cross at the centre. Handles are sometimes made in the same way. Pinnacle features of large designs have usually to be treated in the half-cut manner, and bookshelves, wall cabinets, and many other articles

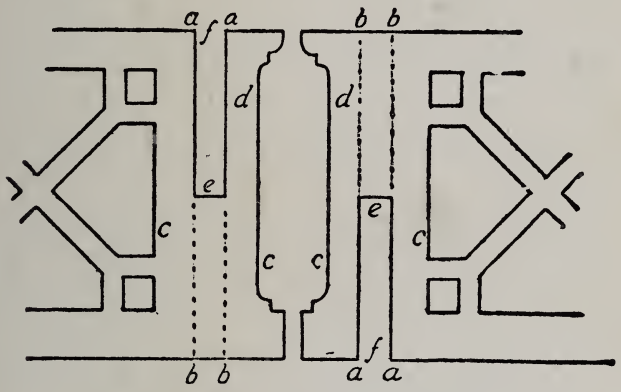


FIG. 4.—HOW TO CUT HALVED JOINTS.

are fitted together with halved joints. The joint is one which the worker meets everywhere, and he should learn early how to cut it so that its hold is effectual.

With halved joints the same preliminary care should be taken as with tenons and mortises. If Fig. 4 represents the corner joints of a box, the lines *a b*, *a b* should be ruled. These must be (1) exactly at right-angles to the top and bottom of the box sides ; (2) they must be exactly parallel to the straight lines, *c*, of the design ; (3) the projecting parts, *d*, must be equal in width ; (4) the slots themselves must be exactly the thickness of the wood used (or just a shade less) ; and

(5) the slot must in each case come half-way through the wood—*i.e.*, each slot must equal in length the solid part of the other piece of wood over which it is to slip. These are merely the obvious considerations which will occur to every thoughtful worker as ordinary precautions to secure accuracy. What has to be borne in mind is that neat fitting is absolutely essential to good fretwork, and that the quickest, easiest and surest way to attain to good fitting is to cut all joints accurately.

In the cutting of the slots it must, again, be remembered that the wood is afterwards reduced by glass-papering, and that, therefore, a slightly tighter fit is wanted in the first instance. Too tight a fit must be guarded against, as extra pressure may split the wood. If a slot is too tight its edges may be rubbed with a file or with a piece of glass-paper wrapped round a thin bit of wood.

At first the worker should cut his slots quite parallel. If, when fitted, the mouth of the slot, *a a*, does not seem to fit closely, it probably means that the fit is too tight at *e*, and a little easing here may put matters right. Experienced workers sometimes rule their parallel lines so that the mouth, *a a*, of the slot is just the faintest shade *less* in width than the width at *e*. This means that the slot will have a slight spring, and the mouth will in this case fit closely.

It is often desirable, as in the case of tenon joints, to saw halved slots before the general fretting is done. This, however, must depend on the character of the design. In many cases a halved slot (especially if it is a long one) temporarily weakens the fret, and when this is so it should be left till the end.

The Locking Joint.—This joint is most commonly found on corner brackets and corner cabinets, but is also introduced in other ways. The principle is almost self-explanatory in Fig. 5, which shows the two sides of a corner bracket. The simplicity and strength of the

joint are apparent. Alternate notches and projections are, in depth, equal to the thickness of the wood, and if the parts are cut to fit tightly the joint is a satisfactory one. Indeed, a corner bracket, if fitted in this way, and with shelves which are tenoned at each side is an article which almost holds itself together. The joint, however, has to be properly set out.

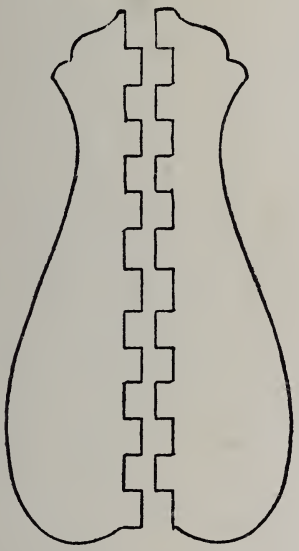


FIG. 5.—LOCKING JOINT FOR CORNER BRACKET.

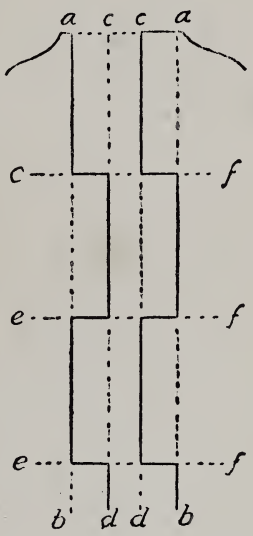


FIG. 6.—HOW TO CUT LOCKING JOINTS.

The plan of ruling and squaring-up fretwork joints on a diagram must be practised from the outset. There is no trouble in it ; it takes little time, and it saves endless adjusting afterwards, unless the fretcutter is content to leave his work badly finished. If the diagrams are pasted to the wood, any ruling should be postponed till the pattern is dry. If they are traced, the ruling

may be done at the time. If the two sides are cut together, the testing must be left over till all the ornamental part has been cut and the woods have been separated. Although the sides may be similar in design, the corresponding slots and tenons of the back edges are necessarily ranged alternately, and the parts have, of course, to be cut separately.

Turning to Fig. 6, which represents a section of the two sides, lines *a b*, *a b* should first be ruled, these lines representing what will be the inner angle of the corner bracket when fitted up. Lines *c d*, *c d* are next drawn. These should purposely be kept a little beyond the outer line of the diagram. Thus, if the thickness of wood being used is $\frac{1}{4}$ in., the depth of the notches and tenons should be ruled at *fully* $\frac{1}{4}$ in. After the work is fitted, the projections will be planed or glass-papered flush.

At this stage the wood may be cut through on each side at *c d*, *c d*, the pieces laid flat on the bench, edge to edge, and the series of lines *e f*, *e f* ruled. These *e f* lines are at right-angles to the edge, and if the worker has a draughtsman's set-square he will find it a useful accessory for the purpose. When cutting the joints, especial care must be taken to have the inner corners square and sharp, and to watch the continuity of the lines *a b*. Any irregularity in these *a b* lines will be noticeable from the front. In running through the cross lines, *e f*, it is worth while to keep just on the *edge* of the pencil line rather than *on* it—that is, to cut so that each tenon is just a hairbreadth wider than its corresponding notch. In doing this, care must be taken not to cut on the wrong edge of this pencil line, for if each tenon is a hairbreadth *less* than the slot the fit will be loose all through.

When the article is fitted up, it may be glued if thought necessary, or it may simply be screwed at two or three points—one screw at each end, and either one, two, or three along the edge, according to the size of the article.

The Wedge Joint.—This is sometimes called a *dovetail joint,* but as in its simple form it is far removed from the real dovetail, the humbler term *wedge* will serve our purpose. In fretwork it is used to join up two parts of a piece which has been too large to conveniently cut in one section. From Fig. 7 it will be seen that the joint is an emergency rather than a constructional one.

When introduced on designs the wedge cuts are usually in places where they will be hidden from view. Fig. 7 is part of a long bracket, the upper and lower sections of which have been cut separately. The dividing line, *a b*, is where the shelf comes, and, if cut neatly, it and its wedges, *c*, will be hidden. The shelf will be tenoned and screwed.

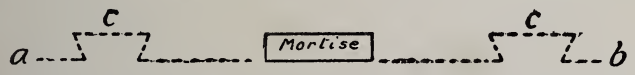


FIG. 7.—THE WEDGE JOINT—USED FOR CONNECTING PIECES WHICH ARE OTHERWISE SUPPORTED.

The wedge itself is not a strengthening joint, but its very form ensures that the two parts are held close together. In cutting it the great aim must be to have the straight edges lying close and the wedge fitting tightly at every corner. If both parts of the diagram can be pasted or transferred to one large piece of wood and the line *a b* (with its wedge joints) cut, then the fit will be glove-like. When this is not practicable, first cut the part which has the wedge projections, or pins. Lay this on the corresponding board and, with a sharp penknife or other tool, carefully scratch the lines for the notches.

Dowel Joints. — Dowelling is a method of fixture which the ordinary fretwork amateur rarely attempts. Its use is never (or hardly ever) indicated on designs. Among those who have had experience in carpentry or cabinet work, however, the dowel is a favourite joint.

Dowels are used instead of tenons, and also sometimes instead of wedge joints. When used in either case it is chiefly for the purpose of having a hidden fixture. In the case of $\frac{3}{16}$-in. wood, or less, they are not often employed, but with $\frac{1}{4}$-in. or $\frac{3}{8}$-in. thickness they may be used to advantage.

We can suppose that, between two shelves of some large article cut in $\frac{3}{8}$-in. wood, there are one or two brackets, such as Fig. 8. For certain reasons assume

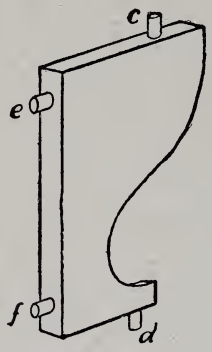


FIG. 8.—DOWELS.

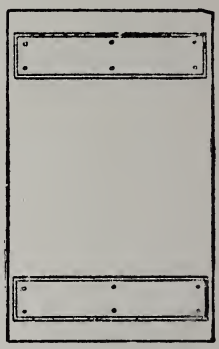


FIG. 8A.—BATTENS.

that it is not desirable to use tenons or screws, and yet that it is essential to secure strength.

This is a case for the dowel. Dowelling may be bought in almost any size. It consists simply of lengths of turned spindles, circular in section, from $\frac{1}{8}$ in. diameter upwards. For the present purpose $\frac{1}{5}$-in dowels will do ; four of these, about $\frac{3}{8}$ in. long, will be required—two for the back of the bracket, one for the top and one for the bottom. At each of these edges drill holes to receive the dowels. These holes must not exceed $\frac{3}{16}$ in. in depth (*i.e.*, half the length of the dowel), whilst in diameter they must be small enough

to hold the dowel tightly. Glue the hole, and press the dowels firmly in. If Fig. 8 is referred to, it will be seen that the dowels at top and bottom (*c* and *d*) are near the front of the bracket ; this gives the bracket a better hold, as it is well secured at the back by the two remaining dowels, *e* and *f*.

Now take the background, against which the bracket is to rest, and the two shelves. Very carefully mark on these the *exact* positions the dowels will take, and on these spots drill holes to receive them, these also being $\frac{3}{16}$ in. in depth. Before glueing, make sure that everything fits properly. Then glue the edges of the bracket and also the dowel holes ; press the bracket into position ; make sure that no daylight is seen through any of the edges ; and, if all is right, put under pressure until the glue has set.

Battens.—Battens are not joints, but are extra pieces added for strength. Their usefulness will be best understood if we deal with them in connection with cabinet or cupboard doors, or box lids. Fretwork doors are not framed up, as in cabinet work, but are in one piece ; and, if of a fairly large size, they are liable to warp if unprotected.

Assume that we have a cabinet door on which there is no fretting, and which is to be overlaid or inlaid. The door is, say, 15 ins. long by 9 ins. wide by $\frac{1}{4}$ in. thick, and on account of its width it will be desirable to use some means to prevent it from warping. Cut two pieces of wood 9 ins. long, 2 ins. wide, and not less than $\frac{1}{4}$ in. thick. Chamfer the edges neatly (this is always an improvement), place them on the back of the door and screw them firmly. The grain of the battens will, of course, run lengthways ; thus they cross the grain of the door and keep it flat (Fig. 8A).

For light work, such as fretwork ornaments, heavy battens should be avoided, but it is well to use those of adequate strength whenever there may be a danger of

the wood warping. Overlays, for example, are liable to spring off or to break if the wood bends, and a pair of battens will afford them the necessary protection.

MISCELLANEOUS JOINTS.

Fretcutting is not always carried out in thin wood of $\frac{3}{16}$ in., or even $\frac{1}{4}$-in. wood, and workers who go in extensively for overlaying and inlaying frequently require, for small cabinets, caskets and other ornaments, a type of joint which bears more resemblance to cabinet fitting than those just described. The wood used may be $\frac{5}{16}$ in. or $\frac{3}{8}$ in. thick, and for the miscellaneous joints here illustrated nothing over $\frac{1}{2}$ in. thick is contemplated. It must be taken for granted that readers who use the joints are equipped with a shooting board, small plane, suitable chisels and a fine dovetail saw.

The Butt Joint (Fig. 9) is usually glued and nailed, and is not often employed except for toys, models, dolls' houses, or framed articles which will afterwards be finished in such a way that the end grain of the wood will be covered.

The Tongued Joint (Fig. 10) is also a butting joint, but has a thin tongue glued into a groove cut in each piece to receive it.

A Shouldered Joint is shown at Fig. 11. For cabinet framing this makes a strong and serviceable joint.

Rebate Joints. — At Fig. 12 is a simple rebate, suitable for cabinet backs or box bottoms. Fig. 13 is a similar rebate, with the corner rounded, whilst Fig. 14 shows an effective variation of the same joint.

Mitred Joints. — Fig. 15 shows a mitred joint secured by veneer keys. When the joint is cramped up and glued a couple of delicate saw cuts are made at an

FIG. 9.
BUTT JOINT.

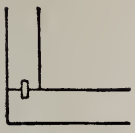


FIG. 10.
TONGUED JOINT.

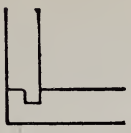


FIG. 11.
SHOULDERED JOINT.

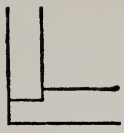


FIG. 12.
REBATE JOINT.

FIG. 13.
REBATE, ROUNDED.

FIG. 14.
REBATE, WITH BEAD.

FIG. 15.
MITRE KEYING.

FIG. 16.
TONGUED MITRE.

FIG. 17.
MITRED REBATE.

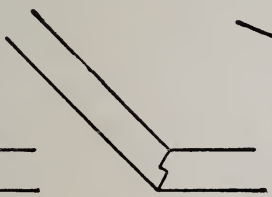


FIG. 18.
MITRED REBATE FOR OCTAGONS, ETC.

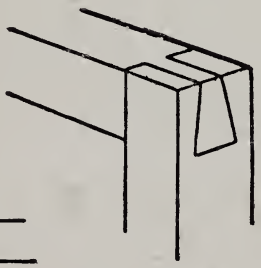


FIG. 19.
COMMON DOVETAIL.

angle, and into each of these is pressed a small strip of glued veneer. As the veneer keys are arranged in opposite angles they form a wedge which prevents the joint from separating. This joint is a neat and useful one for small boxes cut in thin wood.

Tongued Mitre (Fig. 16).—This joint may be used with stouter wood, the thin tongue being glued in similarly to Fig. 10.

Mitred Rebate (Fig. 17). — This is a useful joint for box work, and is preferable to the shouldered and plain rebate joints at Figs. 11 and 12, the end grain not being visible. When boxes or other forms having more than four sides are being made (hexagonal, octagonal, etc.), a mitred rebate as Fig. 18 may be used.

Dovetail Joints. — The various forms of regular dovetailing cannot be dealt with here, but at Fig. 19 is shown the common dovetail joint, the construction of which will be sufficiently clear from the illustration.

Dovetail Grooving (Fig. 20) is a favourite cabinet-work joint when, for example, two ends have to be well secured by cross shelves. The groove is cut with edges on the bevel, as shown. Into this groove the wedge-shaped end of the shelf slides, and when glued it is an immovable fixture. If the front edge of the grooved part is to be seen, the groove is stopped about half an inch from the end so that the joint is masked, the housing part of the shelf being cut back to correspond.

V Grooves.—When partitions in workboxes, jewel caskets, etc., are to be fitted, it is usual to point their ends and cut V grooves in the sides of the box (see Fig. 21). Such partitions are often of $\frac{1}{8}$-in. wood, and the grooves may easily be cut with a woodcarver's V parting tool. If there are several partitions the intersecting joints are usually halved ones, as Fig. 22.

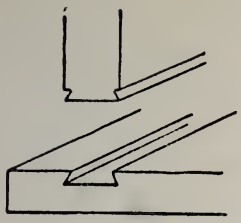


FIG. 20.
DOVETAIL GROOVING.

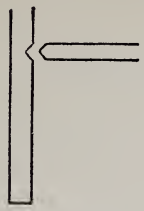


FIG. 21.
PARTITION JOINT.

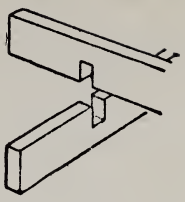


FIG. 22.
INTERSECTING PARTITIONS.

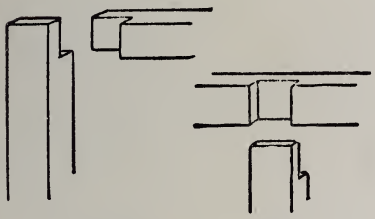


FIG. 23.
HALVED ANGLE JOINT.

FIG. 24.
HALVED T-JOINT.

FIG. 25.
MITRED HALVING.

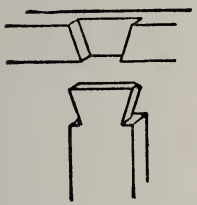


FIG. 26.
DOVETAIL HALVING.

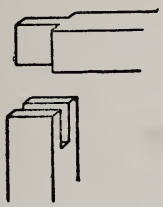


FIG. 27.
ANGLE BRIDLE JOINT.

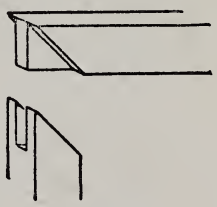


FIG. 28.
MITRED BRIDLE JOINT.

Halved and Bridle Joints.—These are not often required by fretcutters, but may be mentioned. Fig. 23 is the ordinary *lap* or *halved joint* for frames. Fig. 24 is a *halved T-joint*. The *mitred halving joint* (Fig. 25) is neat for light work, but unsuitable where extra strength is required. Fig. 26 shows *dovetail halving*, and at Figs. 27 and 28 are given two examples of *bridle joints*.

The Shooting Board.—This is an accessory which, on the bench, will be found useful in endless ways, especially for planing straight edges, for bevelling, chamfering and for cutting mitred corners. A serviceable

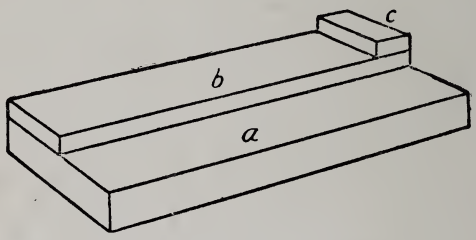


FIG. 29.—SHOOTING BOARD.

one can be made at home, or the local carpenter or cabinet-maker could make one at a small cost.

A large shooting board is more useful than a small one, chiefly because the large one is heavier, and thus more stable. The lower block (*a*) may be of hardwood, from 18 ins. to 24 ins. long, 8 ins. wide, and from 1 in. to 1½ ins. thick. The upper board (*b*) is the same length, but only 5 ins. wide and ½ in. thick. It is firmly screwed to the lower block from below.

The work to be planed is laid flat on the upper board, the end resting on the stop (*c*), which may be 1 in. wide by ½ in. thick. The plane lies *on its side* on the block (*a*), and deals with the wood as it is held over the edge of *b*. In this way all frets which have to be finished with

straight edges, such as panels, doors, shelves, box lids and bottoms, photograph frames, etc., may be finished off with smooth edges.

For bevelled work a shooting board with the upper

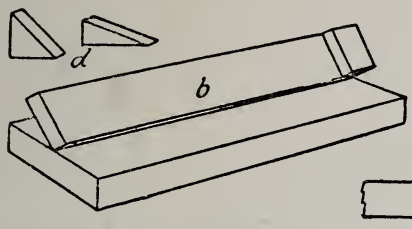


FIG. 30.—SHOOTING BOARD WITH HINGED SLOPE.

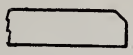


FIG. 31. CHAMFER.

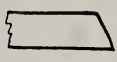


FIG. 32. BEVEL.

block hinged (as Fig. 30) is more useful. The planing is done as before, but the block (*b*) can be held at any regular angle by means of angle blocks (*d*) placed under it. Blocks of 45 degrees, 60 degrees, etc., may be cut

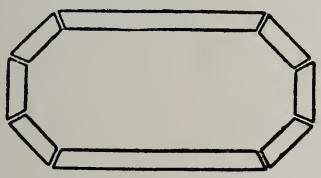


FIG. 33.—EIGHT-SIDED BOX.

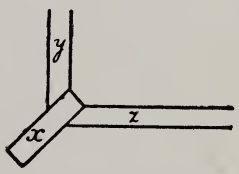


FIG. 34.—BOX WITH ANGLE CORNER.

for the purpose. If a chamfered edge, such as Fig. 31, is wanted, the 45-degree block is placed behind *b* and a shaving taken off the edges of the work. A bevel like Fig. 32 may be taken at any angle ; whilst for six or eight-sided boxes, as Fig. 33, the correct bevels may be planed on the edges, so that all the sides fit closely.

Sometimes, too, fretwork ornaments are made with angle projections, as shown in plan, Fig. 34, *x*. The sides of the ornament (*y z*) have necessarily to butt against the corner piece at an angle of 45 degrees, and the necessary bevel is easily run off with the plane on the shooting board.

A good quality iron plane, not too light, should be used for the shooting board.

FIG. 35.—IRON PLANE FOR USE WITH SHOOTING BOARD.

Fitting Large Work.—The fitting of large work, such as tables, overmantels and elaborate models, has to be taken in a methodical way, and should be carefully planned out. The object must be to secure the maximum strength, and this is largely determined by the order in which the different parts are fitted. These have to be built up so that screws can be passed in at important points ; and as such parts may afterwards be covered by other pieces, a definite plan of construction should be schemed. The lower parts of large articles, such as models, should never be left over till the end, as in this way it is rarely possible to fit them with the degree of security they require.

GLUE, SCREWS, NAILS AND PINS

HOW TO PREPARE AND APPLY GLUE—GLUED JOINTS—HOW TO USE SCREWS—THE USES OF NAILS AND PINS

GLUE AND SCREWS are the fretcutter's best friends if he thoroughly understands how to make use of them. Some workers dispense almost wholly with glue, using it only for overlays or in other cases where no other method of fixture is possible. They make perfectly fitting joints and trust to screws for additional strength. Others prefer a glued joint, and make a practice of avoiding screws. On this question no rule can be laid down. Much depends on the article being made, and the worker himself is usually guided by his own experience. The man who understands what glue and screws can do when properly applied will use each in its own place.

Glue.—The untrained worker must rid himself of the idea that the object of glue is simply to " stick " two pieces of wood together. A mere layer of glue between two boards does not make a permanent joint. In time this layer becomes nothing more than a brittle film which, if the wood expands or contracts, may give way at any moment. The thicker the glue is, the more brittle will the film be, so that a too liberal supply is a drawback rather than a help. What a strong and durable joint means is that the glued parts have been pressed so tightly that they are welded together. The joint is made air-tight, and, as the glue is drawn into the grain fibres, the joined pieces become one.

This means that, when we use glue to join two pieces

of wood together, we must have some means of immediately applying pressure. Without this our joint will only have a temporary hold.

Cake Glue, it may be said, is rarely used by the fret-cutter who does not go in for larger woodwork. The best Scotch cake glue, semi-transparent in colour, should always be purchased. The glue kettle, in which it is melted, consists of an outer pot which holds the water, and an inner pan in which the glue is placed. The glue is broken into small pieces and allowed to soak in water for some hours. The outer pot is then half filled with water, the pan with the partly dissolved glue placed within it, and the whole put on the fire. The glue should be stirred occasionally with a stick, and melted to the consistency of thin syrup. If too thick, a little water may be added. Obviously the glue has to be applied hot, as it immediately thickens and hardens if allowed to cool. Only a small quantity of glue should be dissolved at a time, repeated meltings having the effect of reducing its strength.

Prepared Glues are more convenient to the worker who requires only a small quantity at a time. They are well known—some in tins and some in tubes. The tinned glue (such as croid) has to be melted by placing the can in a cup of warm water, but is otherwise ready for use. Tube glue will always run freely except in very cold weather, when it also may be placed for a few minutes in warm water. Tubes, after use, should be wiped with a damp cloth, as otherwise the opening is apt to get choked.

Applying Glue.—The glueing of overlays is dealt with in a later chapter, and these remarks apply to the glueing of halved, tenon and other joints. Cake glue is applied hot, and it is usually wise to warm tubes in order that the adhesive may run freely. It is also well to warm the joint before applying the glue. This is not always

possible, but, when done, it has the advantage of preventing the glue from hardening before pressure can be applied. If the glue thickens too soon, it has the effect of producing the filmy layer to which reference has been made.

Glue is sometimes applied with a small and fairly stiff brush, sometimes it is spread over the joint with a penknife, and sometimes with a pointed stick. Not infrequently the point of the third finger is used to coax it evenly over the joint. A joint should be well covered so that air will afterwards be excluded, but nothing is gained by putting on more glue than is required. In the case of a loosely-fitting joint an excess of glue is little help, whilst if the joint fits tightly the superfluous glue is squeezed out under pressure.

Glueing Tenon Joints.—Here it is the mortise (or slot) and not the tenon that should receive the glue. If we glue the tenon, too much of the adhesive will be driven upwards as the joint is pressed home. On the other hand, if we glue the edges of the mortise well, we can better ensure a grip at all points, and any surplus will be sent downwards.

Of course, a tenon joint must fit closely if the glue is to hold, and its own tightness gives us the equivalent of pressure. If the joint is loose, and if the wood later shows any tendency to warp or split, the brittle glue, not having gripped the grain, will crack and give way. Pressure in any case should be applied, as it is essential to prevent any possibility of the parts slipping or otherwise yielding whilst the glue is hardening.

Glueing Halved Joints.—Reference to an illustration of a halved joint in an earlier chapter (page 78) will show that the problem differs slightly from that of the tenon joint. As a rule, the halved slots are long, but the fact that the joint itself is an inter-locking one means that it is less dependent on glue. What chiefly

concerns us is to see that the half-detached projecting ends are secured. This is done by glueing the edges of the slots and applying pressure when the parts are fitted.

This is a detail in fretwork fixing where many amateurs fail. One reason may be that the joint has not been cut to fit, but the chief cause of trouble is that the means of pressure has not been thought of in time. Before we glue any joint we must have our pressure appliance ready ; and thus, to avoid waste of time, it is well to have some other work on which we may engage whilst a glued joint is setting.

Wood or metal cramps are very useful in the case of halved joints, but care should be taken to prevent the fret from getting injured by the jaws. In many cases it is impossible to use cramps, and some scratch device has to be improvised. Stout elastic bands provide excellent cramps for small work, and if the work is held in a vice, or otherwise made secure so that both hands are free, they can be adjusted to give very strong pressure. In the case of pinnacles, finials, etc., which are halved, the necessary pressure can be applied by tying a length of soft wool around the parts. Twine must not be used, as this cuts into the edges of the wood.

Other Joints.—In the case of the more rarely used joints, immediate pressure is the secret of success. Arrange beforehand how this is to be applied. If there is neither a tenon nor a halved joint for guidance as to position—that is, if the joint is a butting one—make sure that the edge of the one part is accurately straight and that it is placed correctly in its right position. If a butting joint meets at an angle, note that the bevel is correct so that the parts will be flush right along the line.

As a certain amount of glue always oozes out under pressure, as much of this as possible should be wiped off with a rag whilst still wet. Afterwards, when the joint has set, the wood may be carefully cleaned up with glass-paper.

Screws.—It will be understood that, for fretwork purposes, only the finest gauge screws can be used. The most useful lengths are $\frac{3}{8}$ in. and $\frac{1}{2}$ in., but other sizes sometimes required are $\frac{1}{4}$ in. and $\frac{3}{4}$ in. A $\frac{3}{16}$-in. screw, although obtainable, is awkward to handle, and when a very small one is required it is better to use $\frac{1}{4}$ in. and then file off the projecting point after the screw has been passed home.

Screws may be had in iron or brass, and with flat heads or round heads. The iron screws are stronger, but are less frequently used on account of the better sense of finish which a brass one gives. In very hard woods, however, a brass screw is liable to break unless a good sized hole has been drilled. If the screw is to be visible, a round-headed one is preferable.

The Use of a Screw should be thoroughly understood. A screw is not driven through one piece of wood into another like a nail. A nail is firm in both pieces. A screw, on the other hand, fits loosely (or at least easily) into the upper piece, and then by means of its thread draws and keeps the other piece close.

Many a screw is broken and many a fret split because the hole in the upper board is too tight a fit. It should be drilled so as to take the screw shank easily. For a hinge we use a screw which fits loosely into the hole, and in the same way the screw must run no chance of getting locked in the upper board of wood. The hole should also be very slightly countersunk to take the screw head. This can best be done with a regular rose-bit, but, failing this, the countersinking can easily be effected with a penknife. The head of a screw is wedge-shaped, and if provision for this has not been made the final turn may cause the wood to split.

Marking for Screws.—As neatness of finish is as important as accuracy in cutting, no hole should be drilled for a screw until the exact position has been

ascertained and marked. For example, if we are screwing on a bracket shelf from behind, the screws should be spaced equally apart and should all be correctly in line. They should also be placed at points where the wood is strongest. When the holes are drilled, the shelf may be held temporarily in position. By passing an awl or stout needle through the holes, the correct points of entrance may be marked on the back edge of the shelf. If the drill is then taken, holes may be bored in the shelf exactly on the centre line of the edge. By careful marking in this way we avoid the little pitfalls that so often lead to accident.

Holes for Screws can always be safely bored with the ordinary archimedean drill; but, if the fret is a delicate one, or if the screw has to come at a point where the grain is short, it is well to mark its position and drill the hole before cutting is done. This hole must be large enough to take the shank of the screw right to the head. If this is neglected, the worker must be prepared to risk a split.

So far as the hole for the under piece of wood is concerned, all that is necessary in the case of soft woods is to secure a start for the screw. Hard woods, such as oak, rosewood and ebonia, will require a deeper hole, especially if brass screws are being used. When, too, a screw has to pass into the *edge* of a piece of wood not more than $\frac{3}{16}$ in. thick, it is wise to drill deeper in order that it will go in straight.

The Driving of Screws is only troublesome because they are small and difficult to handle. A convenient way of holding them is to take a strip of stout paper about 3 ins. long and $\frac{1}{2}$ in. wide and press the screw through this. The screw may in this way be held vertically until it grips the wood, and the paper is then torn off. If, however, holes are properly drilled there should be no need for this holder.

The two pieces of wood to be screwed should be held closely together in order that the screw may go easily home. A fine-pointed screwdriver should be used, and, when the blade grips the wood, slipping should be avoided. Do not use force at the last turns ; if countersinking has been attended to, the head will go flush with the wood without any risk of a split. A touch with glass-paper will remove any roughness.

Nails are rarely used in the fitting of ornaments, but for models, toys, etc., and in endless incidental ways, they are required. Wire and brass nails may be had in all sizes from $\frac{1}{4}$ in. upwards, and an assortment should always be in the tool box. When two or more boards are fixed together for plural cutting, it is usual to do this with wire nails, and smaller brass nails are useful for securing handles and other metal ornaments. On the best work, however, nails should never be used as a substitute for screws.

When employed on plainer work, it is usual to pass in nails slantwise in pairs. In this case it will be seen that each pair of nails acts like a wedge. If driven in straight the smooth wire would give an inadequate hold. If the wood is thin, it is always wise to drill a small hole to give the nail a start.

Pin Points are frequently used on very fine work. Needle points are similar in effect, but have the disadvantage of being brittle. Household pins can be had in various degrees of fineness, and may be cut with the pliers to any length. Instead of being driven in with a hammer they are usually pressed in with pliers.

A hidden pin-point fixture is sometimes effected in this way : into one piece of wood the blunt end is forced with the pliers, and on the projecting point the other piece is pressed. This plan is sometimes adopted with overlays, but otherwise is only used, along with glue, in the case of very small work.

MISCELLANEOUS FIXING AND FITTING

FIXING HINGES ON BOXES AND DOORS—PHOTOGRAPH FRAME STRUTS — FITTING PHOTOGRAPHS AND MIRRORS —TURNED MOULDINGS, TOES AND SPINDLES—METAL AND OTHER FITTINGS

APART from the ordinary fixing operations in fretwork the reader requires a knowledge of miscellaneous fitting, such as screwing on hinges, fixing photograph frame struts, framing photographs and mirrors, applying turned mouldings, etc.

HINGES.

Hinges employed for fretwork purposes are of two kinds: the ordinary brass butt hinge, and ornamental hinges of various sizes and styles. The plain hinges may be had from $\frac{3}{8}$ in. upwards, and the thickness of wood used has to be considered when determining the size. The size of screw used must necessarily depend on both hinge and wood. Butt hinges may be had nickelled as well as in brass, whilst the fancy ones are obtainable in many different styles of finish.

Fretwork hingeing calls for a considerable degree of neatness and no little patience. The chief difficulty is on account of the thinness of wood used, and if we are dealing with boards no more than $\frac{3}{16}$ in. thick, we are faced with the problem of finding an adequate bearing for the screws. A secondary difficulty—though by no means a small one—is that tiny hinges and screws are awkward to handle, especially by the man who hitherto has been accustomed to butt hinges of 2 ins. or 3 ins. These difficulties have to be overcome, because in this

case neatness and strength go together—a neat fixture usually means a strong one.

Box Hinges.—The simplest and plainest boxes are usually hinged as at Fig. 1. Here the upper flap is fixed to the under face of the wood, while the lower flap is screwed to the edge. It is always wise to cut a shallow bed for the flap (as at *x*), a similar bed being cut for the lower flap. This is desirable not only on account of neatness, but also because the edges of the bed help to keep the hinge more securely in position. With a well sharpened chisel of small size the bed is easily cut. If

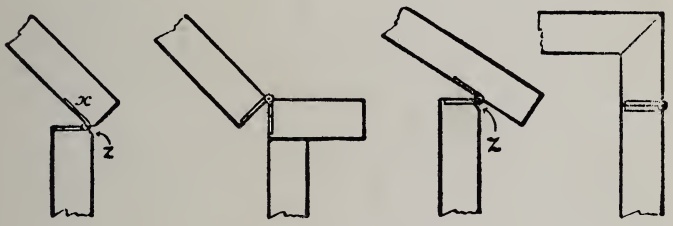


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

DIFFERENT WAYS OF HINGEING BOX LIDS.

a touch of liquid glue is spread over the groove before screwing the hinge this will give an additional hold. The side of the box should have a slightly bevelled edge as at *z*. This lessens the strain on the hinge when the lid is opened.

Sometimes a box is made with a fixed rim and a flush lid, as Fig. 2. In this case each flap of the hinge is screwed to an edge, and thus a larger screw may be used. Indeed, with a box of this kind, many workers will use fine brass nails instead of screws. If fine holes are drilled for these and the nails are driven in carefully, they are quite as serviceable as screws.

A lid as Fig. 3 is also met with, although it is obviously

less satisfactory. The lid here overhangs the back, and as it will only open to the vertical position, there is a strain on the hinge. The position for the flap has to be very carefully marked and a shallow bed cut for it. The hinge will first be screwed to the lid, and it will be found a little awkward to screw the other flap to the edge of the side. The bevel at *z* should not be overlooked, as this prevents the butt of the hinge from acting as a lever.

Caddy lid boxes (that is, boxes which are made with sides and ends to the lid) are hinged as Fig. 4. In such cases special accuracy is required in order that the lid portion will close absolutely flush with the box.

The lift-off lids of boxes have usually an applied rim on the underside to keep them in position. The rim consists of four narrow strips of wood which are glued to the lid so that they fit the inside of the box.

Marking for Hinges and Screws.—Whatever we are hingeing, whether it be a box or a cabinet door or a photograph frame strut, success largely depends on the care taken beforehand in gauging and marking. Not only should the position of the hinge be marked, but a mark should be made for the position of each screw. With very small hinges there is no margin for even a slight misfit, and if the hole we drill for a screw is not exactly in its right place the screw cannot be driven in straight.

Directions for screwing have already been given, but as $\frac{1}{4}$-in. screws have sometimes to be used for hinges, special neatness is required to give the necessary strength. It is most important to drive the screws in straight and to avoid scratching either the hinge or the screw.

Door Hinges.—Small cabinet doors, if fitted with butt hinges, are usually hinged as Fig. 5. That is, the cabinet has a fretted framework, to the edge of which the door is hinged. If the door opens right over the

end it is hinged as Fig. 6, on the same principle as the box lid at Fig. 1. In both cases what the worker has to watch is that the door is in alignment and will close properly. This is particularly necessary when the cabinet is fitted with double doors.

FIG. 5.—DOOR HINGED TO DOOR FRAME.

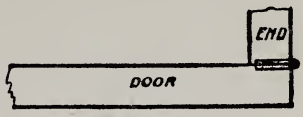


FIG. 6.—DOOR HINGED TO CABINET END.

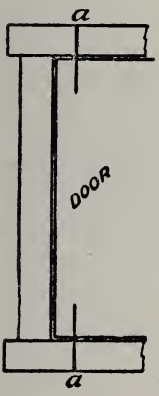


FIG 7.—PIVOT HINGE.

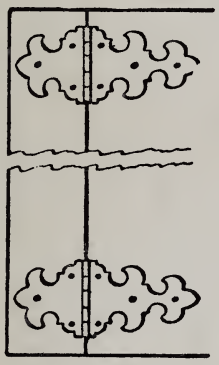


FIG. 8.—ORNAMENTAL HINGES.

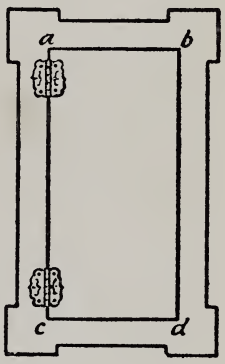


FIG. 9.—BOX LID HINGES.

The pivot hinge, as Fig. 7, is in the nature of a make-shift, but is often used in doll's furniture where provision for even a small butt hinge is lacking. We have, for example, a small doll's cupboard, with two doors. If two pins are cut and passed in at top and bottom, as *a a*, we have a neat (if not very strong) pivoted door. The positions for the pins must be most carefully marked, and fine holes should be drilled for them in the edges of

the door. If these preliminary precautions are taken, the pivot hinge is a much stronger one than might be imagined.

Ornamental Hinges.—These, if the design permits of them, are far more easy to fit than butt hinges, and for boxes and cabinets fancy hinges are frequently schemed. The less ornate styles (as Fig. 8) are preferable, but the embossed and gilt patterns are suitable for many designs.

There is little difficulty in gauging for these ornamental hinges, and in the case of light work they may often be held with fine brass pins. The work should be held on a flat iron or other metal surface whilst knocking in the pins, so that they may be clinched below. If screws are used for a pattern like Fig. 8, small round-headed ones should be chosen.

When a cabinet door or the lid of a box is cut from the general framework, as Fig. 9, and when flat ornamental hinges are to be used, the difficulty of alignment is easily overcome by fixing the hinges before the centre part is cut away. Assuming that the fretting otherwise has been carried out, drill a small hole and cut along the line *a c*. The hole may be at a point where one of the hinges will come. Now fix the hinges in position, and afterwards cut from *a* to *b*, *b* to *d*, and *d* to *c*. The lid or door is thus certain to close correctly.

Photograph Frame Struts.—Struts, unless properly fitted, are a constant source of trouble ; and, as photograph frames are articles that come in for a certain amount of handling, the struts have to be secure. They must be so fitted that the frame stands at the correct angle, and some means has to be taken to prevent the strut from slipping back. To lessen the chance of side-play, as wide a hinge as possible should be used, and, if the width of the strut permits, it is better to use two small hinges than a single large one.

One method of fixing a strut hinge is shown at Fig. 10, each flap being indicated as bedded into the wood. After the strut has been hinged, a small block of wood (*a*), the same width as the strut, is bevelled on its under edge and glued on. The bevel prevents the strut from spreading out beyond a certain angle, the bevel itself determining this angle.

If the wood of the frame is too thin for receiving the screws, the alternative method shown at Fig. 11 may be

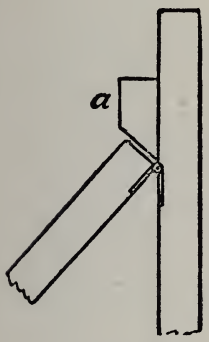


FIG. 10.

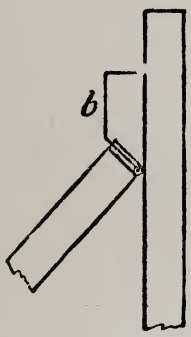


FIG. 11.

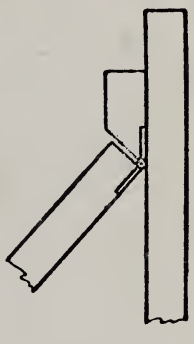


FIG. 12.

METHODS OF HINGEING PHOTOGRAPH FRAME STRUTS.

adopted. In this case the hinge is screwed to the edge of the strut and to the edge of the bevelled block (*b*), and the block then screwed or glued to the frame.

Fig. 12 shows another way of fitting the same hinge, both flaps being bedded into the wood.

The Leather or Tape Hinge is often much more convenient for struts, especially when the frame is of a small size. This is indicated at Fig. 13. The strut is attached at the back to a bevelled block by means of a piece of leather or canvas (*a*) cut neatly to shape. The block is then glued or screwed to the frame. The block

is bevelled on the under edge to the desired angle (or both block and strut may be bevelled), and it is well to gently round the back edges of block and strut to lessen the chance of the leather or canvas being cut.

Photograph Screens.—The special form of fretwork hinge, known as the reversible or double-folding hinge (Fig. 14), is used for folding photograph frames of the

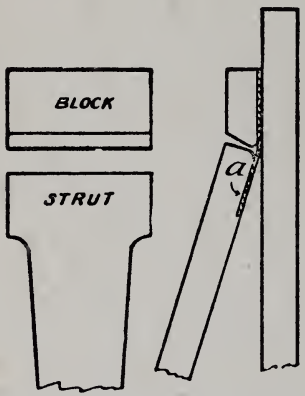


FIG. 13.—LEATHER HINGE FOR STRUT.

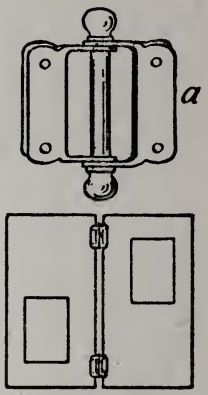


FIG. 14.—REVERSIBLE HINGE.
FIG. 15.—FOLDING FRAME.

type of Fig. 15. Each arm of the hinge (*a*) has two flaps, the width between them being about $\frac{5}{16}$ in. These double flaps grip the wood, and small brass pins are used to hold the hinge. The leaves of the frame stand well apart, and the hinge permits them to fold flat. Another advantage is that the hinge will fold back to a right angle, and is thus specially useful for a three or four-leaved screen.

Reversible hinges are usually made to suit boards of a thickness of $\frac{3}{16}$ in.

PHOTOGRAPH AND MIRROR FRAMING.

Photographs and Small Mirrors are usually framed with an overlay rim. Fig. 16, for example, represents a photograph frame and Fig. 17 a mirror

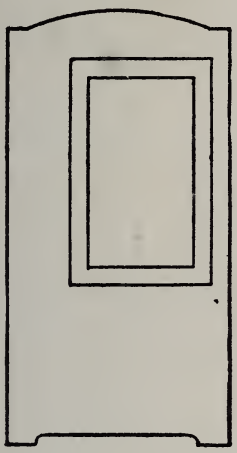


FIG. 16.—PHOTOGRAPH FRAME WITH OVERLAY RIM.

FIG. 17.—MIRROR FITTED WITH AN OVERLAY RIM.

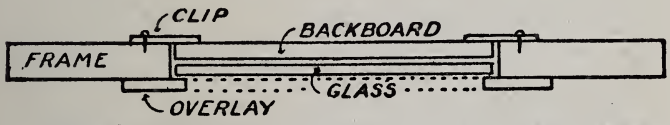


FIG. 18.—SECTION OF FRAMING WITH AN OVERLAY RIM.

frame. In each case an opening will be cut in the back to take the glass. At the front this glass is held by means of a plain or ornamental rim which, cut in thin wood, is glued on as an overlay. As the daylight opening of the overlay is slightly less than the back opening, a rebate is thus formed for the glass.

This is shown in section at Fig. 18. When the overlay is glued on, the glass and photograph are placed in position. To hold them, a thin backboard is cut, and this is secured by means of small metal photograph clips screwed to the back of the frame. The back will appear as Fig. 19. A special advantage of this method of fitting is that the entire back of the frame is flush, and that thus there is no difficulty in providing for a strut.

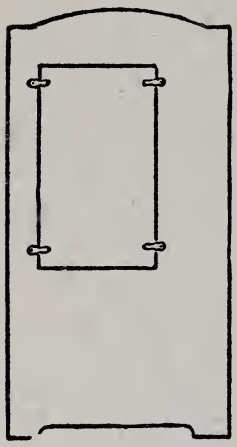


FIG. 19.—BACK OF PHOTOGRAPH FRAME.

FIG. 20.—CLIP.

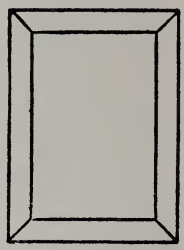


FIG. 21.—BACK FRAMING.

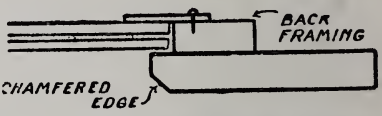


FIG. 22.—SECTION OF BACK FRAMING.

Small mirrors may be fitted in the same way; or, instead of making use of metal clips, the backboard may be cut to fit tightly and be glued in.

Back Framing.—If a frame has no overlay, a light back framing must be fitted to take the photograph. This is done by taking four narrow strips of wood, as Fig. 21, mitreing them at the corners and glueing them to the back. Strips $\frac{1}{4}$ in. wide and about $\frac{3}{16}$ in. thick will serve. They are not fitted close up to the picture

opening, but are set back about $\frac{1}{8}$ in. at each side to provide a rebate. The method of fitting is shown at Fig. 22 and, apart from the overlay, is similar to that at Fig. 18. On account of the photograph being more deeply recessed, however, it is an improvement if the edges of the frame opening can be chamfered as indicated.

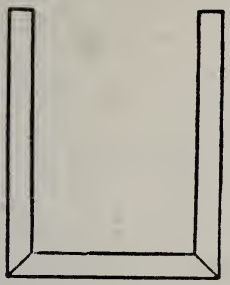


FIG. 23.—ALTERNATIVE BACK FRAMING.

FIG. 24.—OVER-ALL BACK-BOARD WITH THUMB SLOT.

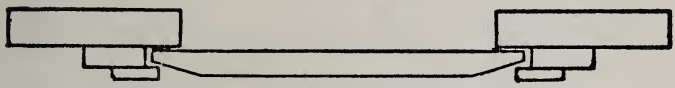


FIG. 25.—FRAMING MIRROR WITH TWO OVERLAYS.

An alternative method is to omit the top bar of the back framing, as Fig. 23, and fix on an over-all back-board with thumb slot, as Fig. 24. The glass and picture are slipped in from above.

Double Overlays.—Larger and heavier mirrors are usually fitted with two overlays. This is shown at Fig. 25. The lower overlay, which is glued to the ground wood, is thicker than the upper one, and has its opening cut to fit the glass. Above it is glued (or in some cases screwed) the second overlay, the inner line of which overlaps the mirror and thus secures it.

Frames for pictures or larger sized photographs are frequently fitted up in this way.

TURNED MOULDINGS, ETC.

Turned Mouldings are often introduced very effectively on fretwork ornaments. The character of these mouldings may be gathered from Fig. 26, which shows some full-sized examples. They may be had round, half-round and quarter-round, and in diameters of $\frac{1}{8}$ in. upwards. Supplied in lengths of three feet or more,

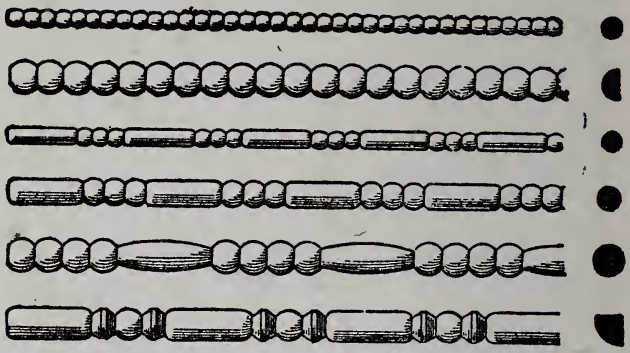


FIG. 26.—EXAMPLES OF TURNED MOULDINGS.

they are easily fixed, but care should always be taken to mitre them neatly at the corners, as Fig. 27.

The half-round and quarter-round mouldings are simply glued on. The full-round ones are more troublesome to glue, and usually require the addition of a few fine pin points carefully pressed in.

Toes and Spindles.—In addition to these turned mouldings, spindles and toes of various sizes (of which a few examples are given at Fig. 28) are obtainable. As a rule these are provided with dowels so that there is little difficulty in fixing. Toes are frequently dowelled to small plinths, and these plinths then glued or screwed to the bottom of a box or casket. If plinths

are not used, the toe has to be dowelled direct into the bottom.

For balustrading on overmantels and large brackets, turned spindles are very useful. They require, however, to be fitted carefully—all equally spaced and all correctly vertical. To space them equally is a simple matter, and

FIG. 27.—TURNED MOULD MITRED AT CORNER.

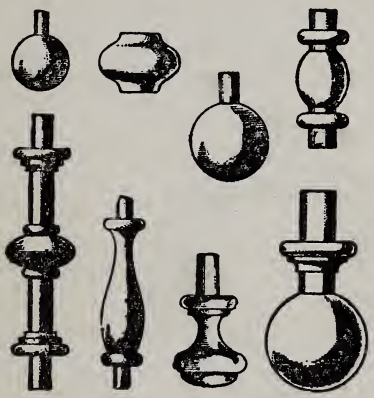


FIG. 28.—EXAMPLES OF TURNED SPINDLES AND TOES.

to secure alignment otherwise the following method should be adopted. Assuming that the spindles are to be fitted to a shelf below and a rail above, both rail and shelf should be fastened together before boring for the dowel holes. Space out according to the number of spindles to be used, and carefully mark the centres for boring. If then the holes are drilled or cut correctly, the fit will be accurate.

METAL AND OTHER FITTINGS.

Handles, corners, photograph frame mounts and other metal ornaments were at one time extensively

used on fretwork articles. They give no trouble in fixing, being usually pinned on with small brass nails. Occasionally small cabinet fittings are required, such as catches, flush bolts, etc., these being fixed with screws in the usual way.

Locks are less rarely used on account of the thinness of the wood, and a well-finished lock which does not require letting in should be chosen. The keyhole should be carefully marked and cut, and provided with a neat escutcheon.

FIG. 29.—GILT METAL ORNAMENT.

FIG. 30.—BEVELLED MIRROR.

Clocks specially made for fretwork cases are supplied by dealers in fretwork materials. They are encased in a drum, and have a front flange which can readily be screwed to the woodwork.

Many other accessories, such as ink-wells, flower glasses, cruet fittings, scent bottles, barometers, thermometers, etc., are manufactured to suit certain published designs. The war temporarily stopped the supply, but when the industrial equilibrium is restored these and many other accessories will be available. They do not call for any special mention as regards fitting.

Care in Fitting.—This chapter must not close without a word of warning. Down to the last detail in miscellaneous fitting, the same care should be exercised as in cutting. Indifferent finish betrays the amateur; patient and careful fitting reveals the intelligent mind as well as the expert hand. The work is not difficult, but it calls for time, patience and neatness. On his best work the professional cabinet maker grudges neither time nor labour, and to the fitting of a hinge or lock he will devote as much care as to the dovetailing of a drawer or the framing of a moulded door. He knows that the best finish pays, and the fretcutter will find the same.

BACKGROUNDS, BASES, BOX LINING, ETC.

VARIOUS BACKGROUNDS—SOLID AND BUILT-UP BASES—LINING BOXES AND CASKETS — LINING ORDINARY FRETS

SOLID BACKGROUNDS are occasionally required for fretted wall ornaments of a delicate character. The inexperienced worker, whose judgment is not fully trained, is apt to cut an elaborately shaped background, and perhaps finish this with a covering of bright plush. Now, the intention of a background is, firstly, to give protection to the fret; and secondly, to throw it up to the best advantage. Any solid ground will afford the necessary protection, but it is clear that a gaudy setting will draw attention to itself and thus rob the fret of what is due to it.

A Background should be comparatively plain. It may be square, rectangular, circular, or it may be an oval, according to the general outline of the fretted design. Any strongly marked shaping of the outline should be avoided; and, if something more than mere plainness is desired, the ideas suggested at Fig. 1 may be followed or adapted as required. Even in the case of square cut or rounded corners, the detail shaping should be kept small.

Backgrounds are usually cut in thicknesses of from $\frac{1}{4}$ in. to $\frac{1}{2}$ in., being strengthened at the back with a couple of battens. If the outline is unbroken, the edges may be chamfered or rounded. Chamfering is also an improvement on any of the examples at Fig. 1, but is more troublesome to carry out at the corners. A wood ground looks more workmanlike than one which is

covered with velvet or silk, and nothing can well beat a mahogany or walnut background stained to a dark colour and polished. White woods may of course be stained to any colour and then polished, or—if the worker is equal to the task—the surface may be veneered.

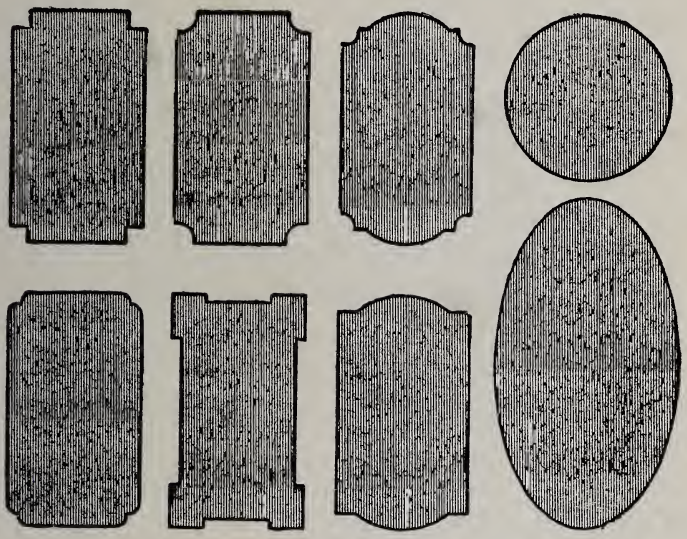


FIG. 1.—SOME USEFUL BACKGROUNDS.

If it is felt that the background should be covered with some soft material, a quiet colour of silk is perhaps the best to use. By some velvet is preferred, but plush should not be used. Delicate work in ivory xylonite looks well on silk, but wood almost invariably has a better appearance if mounted on wood. The silk need not be taken right over the edge of the wood. It is often better to leave an edging of wood (see Fig. 2), and cover the edge of the silk with lengths of half-round turned moulding neatly mitred at the corners.

Bases for models may be of solid wood or may be partly built up. They should at least appear substantial, and (unless the model is a very small one) should be from $\frac{1}{2}$ in. to $\frac{7}{8}$ in. thick. Solid bases may be in section as Fig. 3—that is, with chamfered (*a*) or rounded (*b*) edge, or with a hollow (*c*) or a simple mould (*d*).

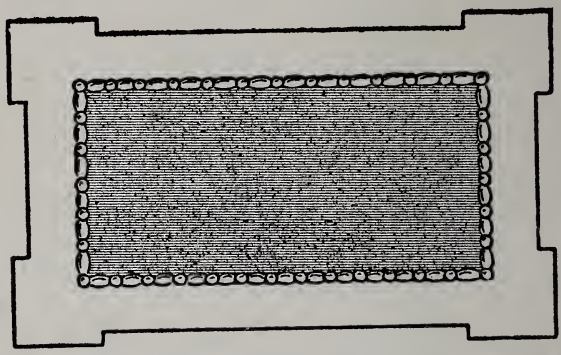


FIG. 2.—BACKGROUND WITH SILK PANEL EDGED WITH HALF-ROUND TURNED MOULDING.

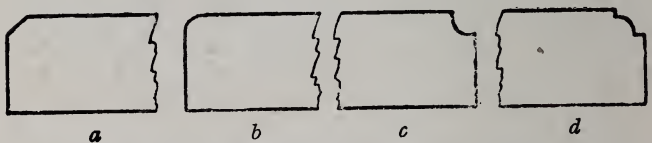


FIG. 3.—FOUR SECTIONS FOR BASES.

Some built-up bases are shown at Fig. 4. The first (*e*) is made up of two boards of $\frac{1}{2}$ in. and $\frac{3}{16}$ in. respectively; *f* is the same, but with the addition of a turned bead edging; *g* has $\frac{1}{2}$-in. and $\frac{1}{4}$-in. boards, with a quarter-round moulding; whilst *h* is built up of three boards, a quarter mould and a bead.

An example of a tall base for a large model is shown at Fig. 5. It is easily constructed, as indicated by the

section, and the application of turned mouldings gives it a handsome appearance.

Lining Boxes.—Fretwork boxes, caskets and similar articles are frequently lined, sometimes with thin wood, sometimes with veneer, and sometimes with silk. The object of this lining is to hide the interior and also protect it from dust. Incidentally, the lining may heighten the effect, but there is always a risk of it making the box appear solid and heavy.

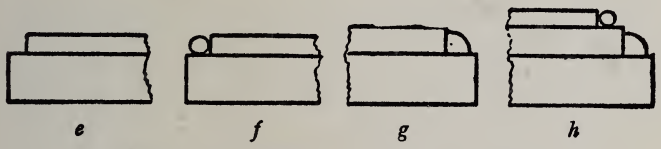


FIG. 4.—EXAMPLES OF BUILT-UP BOXES.

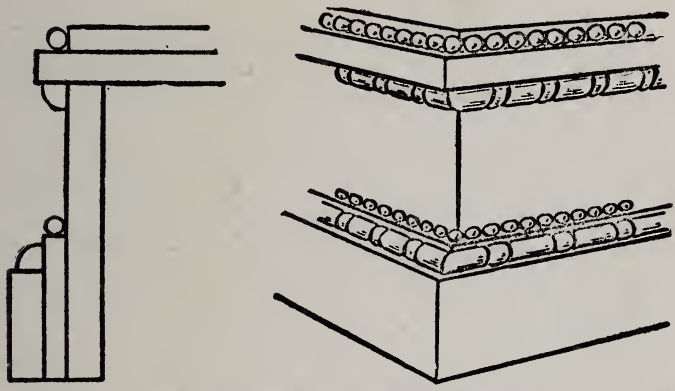


FIG. 5.—BUILT-UP BASE, ORNAMENTED WITH TURNED MOULDINGS —SECTION AND SKETCH.

For a wood lining it is unnecessary to use anything stouter than $\frac{1}{16}$ in. It must, however, be remembered that the thickness makes no difference to the outside appearance, and when the lid is closed even the thinnest

sheet of veneer will look like solid wood. Thus care has to be taken to choose a colour which will lighten the effect. Maple may be mentioned as an excellent wood for the purpose. The pieces are cut to fit the sides (inside the box), and the corners should be bevelled so that they mitre neatly. They are fixed by glueing.

Knife-cut boards of only $\frac{1}{32}$ in. are frequently used for lining purposes, but if ordinary veneer or the very thin Japanese veneer is used this has to be mounted on wood and then fitted in the way just described.

Silk makes a good lining for the more dainty type of box, but some care must be taken to see that the shade harmonises with the colour of the wood. Four pieces of thin wood or stout card are first cut to fit the sides, and around these the silk is strained, covering both faces so that the inside of the box as well as the outside is lined. In this case the bottom also will be lined with silk.

Box lids are usually lined to correspond with the sides. The lining does not, as a rule, come right to the edge, but merely fills the rectangular centre space to correspond with the interior opening.

Lining Ordinary Frets.—The lining (or backing) of ordinary frets can only be given a qualified recommendation. In the case of a box, we are lining the panels of an enclosed object, but the problem assumes a different form when we come to a general fret. A cabinet may be regarded as an article of the box type, and cupboards and cabinets are occasionally lined in the same way as boxes; but ornaments such as photograph frames, brackets, inkstands, clocks, etc., stand on a different footing.

Sometimes a particular section which may be emphasised is picked out and backed with veneer or silk. The emphasis given to this one part does not detract from the general effect. To back the entire fret would mean laying undue emphasis on an outline which

is not intended to be prominent. Lining, in fact, introduces a new and distinct form to the design. The portion lined constitutes this form; thus it should be in the nature of a panel, shield, scroll, or other enclosure, which will bear the prominence that backing gives to it. The writer himself rarely adopts lining of this sort, except, of course, in the case of overlays, which are dealt with later.

Backing may be done with veneer, carefully cut to shape and glued on behind, or it may be done with silk. In the latter case care has to be taken not to stain the silk with the adhesive used.

A CHAPTER ON WOOD

GRAIN AND THICKNESS—RELATION OF WOOD TO DESIGN —CARE OF WOOD—DESCRIPTIVE LIST OF WOODS

THE name " Fretwood " has for long been accepted as a timber term. Generally speaking, it signifies boards of $\frac{1}{16}$ in., $\frac{1}{8}$ in., $\frac{5}{16}$ in., $\frac{1}{4}$ in. and sometimes $\frac{3}{8}$ in., planed and glass-papered on both sides, ready for receiving the pattern to be sawn. The $\frac{1}{16}$-in. boards (called " overlay wood," as it is used almost exclusively for this purpose) have frequently one side left rough from the saw, an unplaned surface being better for taking the glue. Knife-cut sheets of $\frac{1}{32}$ in. are also obtainable.

Wood is sold per square foot ; that is, a piece of 144 square inches, irrespective of length or width, is called a foot. As timber grows, boards of different kinds vary in width according to the size of tree. Walnut, mahogany and satin walnut, for example, may usually be had in liberal width ; maple is a wood obtainable in average widths ; whilst varieties like holly and satinwood can rarely be had wide.

Very highly figured woods are not often to be found, the reason being that the most finely ornamented timber is reserved for veneers. On the whole, this is no serious drawback. Elaborately streaked or mottled woods do not lend themselves to work which is to be fretted ; and when by good fortune a particularly fine board is obtained it should be kept as the background of an inlay or overlay.

Woods vary in price, and this depends less on quality than on kind. Some are plentiful, and are, consequently, inexpensive ; others are scarce, and the price has an

upward tendency. Certain woods have a habit of periodically disappearing. This, however, does not imply that there is no such wood in the country, much less that it has become extinct. It may simply mean that, for a time, the whole available supply is required for manufacturing purposes, and that none is being converted into fretwood.

Grain.—No two woods are exactly similar in grain, and the work of cutting is thus different in each case. Some are exceedingly soft, and the saw travels through them at a rapid rate. Pine, for this reason, is never used except for decorative frets in thick wood. Some woods are open in grain, with the fibres far apart, whilst others are close and compact. The latter usually cut clean and sharp, and do not leave very ragged edges; whereas, with an open-grained wood, the fibres are torn apart, and straggling threads of grain hang to all the edges. Other woods, again, are gummy, and for this reason are hard to cut. Some, like ash, are tough and elastic, whilst certain close-grained woods, though hard, are brittle and easily broken. Only experience will accustom the cutter to the distinctive peculiarities of the many different kinds.

Fancy Woods.—The term may be objected to, but the word "fancy" is sometimes applied to rarer woods of less familiar names which can at times be obtained. What the cutter should learn is to discriminate between the standard woods, which may always be had in useful widths, and those lesser known varieties which appear occasionally and are usually found only in narrow widths. The former are, of course, the useful kinds on which the fretcutter must rely, and to which he should accustom himself. Walnut, mahogany, oak, satin walnut, birch, maple, sycamore and others are usually available in good condition. The supply varies, but they are seldom unobtainable. Padouk and rosewood are

also—though less frequently—to be had in good condition.

Among the so-called fancy varieties may be classed amaranth, bird's-eye maple, boxwood, holly, orange-wood, pencil cedar, pear-tree, sandalwood, satinwood, silverwood, tulip. These, when seen, are worth buying for small ornaments, for inlays, overlays and underlays; but as some of them are higher in price than they are worth, and as their rarity is not always apparent in the finished work, it is rarely advisable to spend much money on them. To workers who go in for combined effects in overlaying and inlaying they are useful.

Wood in Relation to Design.—Too much emphasis cannot be laid on the importance of using wood suitable to the character of design in hand. Not only the size and style of design, but also the use to which it is to be put, must be considered. In this both experience and artistic judgment are necessary; and, apart from some general suggestions, no rule can be laid down. Woods with bold figuring are unsuitable for small articles. Indeed, these look better when the design has a fair amount of solid wood about it. Oak, for some objects, is an indispensable wood, but for many others (especially those of a delicate character) it is inappropriate. White woods are excellent for models, or for articles which require to look light and dainty; but, unless polished, their liability to soil must not be overlooked. As a rule, dark woods, such as walnut, padouk and rosewood, look best for wall ornaments, but in every case the style of the design and the particular character of the detail have to be taken into consideration.

The Thickness of Wood used is equally important. As already stated, $\frac{1}{16}$-in. is the recognised thickness for overlays (except in xylonite and metal); $\frac{1}{8}$-in. is used chiefly for very small objects; $\frac{3}{16}$-in. and $\frac{1}{4}$-in. are

the average thicknesses ; whilst $\frac{3}{8}$-in. is rarely required unless for large articles with bold frets.

Where judgment is required is to decide between $\frac{3}{16}$-in. and $\frac{1}{4}$-in., and several considerations have to be weighed. A flat ornament (such as a frame) which hangs on the wall shows fewer edges than an article of box form, and can thus be of stouter wood. If numerous edges are visible, a thick wood will make the article look heavy. The closeness or openness of the fret is a second consideration, the former requiring a thinner wood than the latter. Large ornaments have a tendency to look undignified if the wood errs on the thin side, whilst in every case the question of strength is a determining factor. When the article itself is practically solid, and when the decoration is obtained by overlaying, a thinner wood is permissible.

Three-ply Wood, consisting of three layers (the grain of the inner layer lying crosswise with that of the two outer layers), is now rarely used for fretted ornaments ; indeed it is not now specially manufactured for fretwork purposes. Unless the glueing has been faultless, pieces of the outer layer are apt to spring loose under the saw, and unless all three woods are of the same colour the exposed edges are very unsightly. Thus, whilst three-ply boards are useful in many other ways, they cannot be regarded as suitable material for the fretcutter.

Care of Wood.—In storing fretwoods—no matter how small the quantity—extremes of heat and cold should be avoided, and boards should never be kept in a damp place. Warped wood is usually the result of carelessness. Boards should be kept flat under a weight, not left lying about. Waste pieces of reasonable size should always be preserved ; they may often save the necessity of cutting into a good board, and will in any case be useful for underlays.

Should a board warp slightly, it will usually straighten if placed under a weight for some days. If the bend is persistent hold the hollow (or concave) side over the steam of a boiling kettle for a few moments, and then hold the rounded (or convex) side before a fire. The steam causes expansion, whilst the heat gives contraction, and with a little coaxing the board will flatten, when it may be placed under a weight. Work which has been cut should be kept under pressure till required, as the exposure of many edges renders it more liable to atmospheric action.

VARIOUS FRETWOODS.

A descriptive list of woods which are frequently or occasionally used for fretcutting purposes may be of interest to the less experienced reader. Several varieties which are rarely procurable are included, not because they are recommended when obtainable, but because they are well-known favourites with the marquetry cutter.

Amboyna is not a regular fretwood, but to many it will be known as a finely-figured yellowish-brown wood, frequently seen on veneered work. It is beautifully mottled and otherwise marked.

American Whitewood.—See *Canary.*

Ash, as a rule, is too coarse in grain for fretwork. Tough and strong, its elastic qualities make it useful in many ways, but the openness of its streaky figure makes it unsuitable for small work. *Hungarian ash,* a very highly figured wood, can rarely be obtained for fretwork, the finer boards being cut into veneers for furniture panels.

Basswood is an American wood somewhat resembling lime or canary. It is only used for large arches, etc., which require thick wood, or for the larger type of toy.

Baywood.—This is the name given to the plainer boards of Honduras mahogany. It is softer, lighter in weight and paler in colour than real mahogany, and its uncertain colour does not appeal to the fretcutter.

Beech is a well-known wood used extensively for chair legs, tool handles, etc. Reddish-brown in colour, it is hard and tough, and, although not a wood that dealers in fretwork materials often list, its superiority for certain classes of work should not be overlooked.

Birch is more generally useful than beech as a fret-wood. The very familiarity of its name is apt to lead some to ignore its real qualities, but for fretwork it is an excellent wood. Pleasant to cut, it has a pleasing light brown colour which, if desired, will readily stain to any darker shade.

Boxwood, though seldom procurable for fretwork, ought to be mentioned. Very hard and close in grain, it is used extensively as a veneer stringing, and is also in great demand for small carved or turned work, such as chessmen, and for tool handles. The supply is limited, and the fact that it is an essential commodity in other ways robs the fretcutter of his opportunity of obtaining it.

Canary is the popular name given to the well-known *American whitewood,* or *American hardwood,* used so extensively for cheaper furniture which is to be stained. It is excellent for toy-making, but its woolly surface makes it less suitable for the ordinary class of fretwork design. In colour it is a yellowish-white, and it is often marked with darker streaks which make it useful (when stained) as an imitation of walnut.

Cedar is a wood of many varieties. *Spanish cedar,* from which cigar boxes are made, resembles a soft mahogany ; and cigar-box wood, if well cleaned up, has many uses. *West Indian* or *Mexican cedar* is redder in

colour, but, although hard, has a tendency to be brittle. *Cispata cedar* was at one time a great favourite with fretcutters, having the advantage of being procurable in wide boards. In general colour and grain these cedars are not unlike mahogany, and the smell of the sawdust is agreeable. The *Cedar of Lebanon*, it may be added, is a garden lawn tree ; the wood, reddish-brown and fragrant, is little used.

Cedar (English) is a soft, yellow wood, exceedingly fragrant, much prized for toy-making. It is not suitable for ornamental fretwork of the smaller type, but is one of the most pleasant woods to use for plain models and toys.

Cedar (Pencil), called also *American cedar*, is different from any of the above. Very soft and light, it is worth trying whenever obtainable. Its colour is more of a rosy-pink than red, and the streaking is even and regular. For overlays it is useful, but it should never be polished in any way.

Cherry, not unlike mahogany at times, but with a smoother grain, is moderately close and hard. Its colour is a mild brownish-red, and it offers no difficulty to the worker.

Chestnut (Spanish) must not be confused with the far more useful *white chestnut*. In some ways it resembles oak, but is a coarser wood and of inferior quality. Choice boards might occasionally be used.

Chestnut (White) is one of the substitutes for holly. It is softer, more open in grain and with bolder figuring. Fairly soft, it is a very useful wood when wide white boards are wanted.

Ebony and Ebonia.—Real ebony need hardly be classed as a fretcutter's wood, as it can rarely be procured. It is exceedingly hard, and only the heart of the wood is black. *Ebonia* is a black-stained wood—usually sycamore. It is so treated that the stain thoroughly

penetrates the grain, and good boards are well worth their price. Ornaments of a Chinese and Japanese character look well in ebonia, and the wood is one of the best upon which to overlay.

Elm is a wood which, like birch, might well be more frequently used, its mildness and richness of colour being too little appreciated by fretworkers, who are inclined to be prejudiced against varieties which bear a homely name. It is tough, close-grained, but easy to work.

Greenheart, only occasionally on the market, is a wood of the olive or orange class, very hard and compact in grain.

Holly (often termed *white holly*) is the purest white wood obtainable, and in its finer boards almost resembles ivory. Few people who have not been fretcutters are even aware that such a white wood exists. The odour of the sawdust is rather unpleasant, and the wood is hard and very compact in grain. The figuring is confined almost solely to exceedingly fine ivory-mottling, which, however, never robs the wood of its whiteness. For large work holly is not recommended, but for small articles and for overlays it is invariably suitable. Inferior holly can be detected from its greenish-blue streaks.

Lacewood is the name given to the elaborately decorated *plane tree*. It is reddish in colour, densely mottled, and looks best when the figuring is small. Many workers dislike such strongly accentuated markings on fretted work, but if the article is not too small the effect is sometimes good. For underlaid panels or for large grounds on which overlays are to be glued it is a very useful wood. On account of a rather woolly surface a careful finish with fine glass-paper is necessary.

Lime is a soft white wood, only used for bold decorative fretwork. Whilst fairly close in grain, it is soft and free from knots.

Mahogany, like oak, is of many varieties, perhaps the best known being Cuban, Honduras, Mexican and African. Genuine mahogany is getting scarce, with the result that many other woods, similar in grain and colour, are sold under the name. Although regarded as the premier furniture wood it has never been the fret-cutter's first choice, due probably to the fact that it usually looks its best when french polished. In colour it varies from pale to deep red, while the marking grades from plain streaks to rich and elaborate figuring, the curly and feathery character of which is so well known. Hard and close in grain, it is a wood which requires careful finish with glass-paper.

The plainer boards of *Honduras mahogany* are frequently known as *baywood.* To woodworkers this mahogany is familiar as the wood used for cabinet interiors, drawer sides, etc., and as the ground wood for veneering.

Maple (Bird's Eye), or *curled maple,* is fine and highly figured maple, the best boards of which are usually reserved for veneers. Yellow in colour, the depth of its tone depends largely on its figuring, the features of which are innumerable series of small knots which have suggested the name of " bird's-eye." The heavily figured wood is hard, very close and difficult to cut, and if allowed to get scorched by the saw the smell is unpleasant. Bird's-eye maple is usually catalogued at a high price, but many of the figured boards of white maple are equally serviceable for fretcutting purposes.

Maple (White) has for long rivalled satin walnut as a fretcutter's wood. If not the favourite, it is at least the most generally used of white varieties. In whiteness it is not quite equal to holly, sycamore or white chestnut, but, on account of the large quantity imported, it is more readily obtained in good condition. Hard and compact, it is a pleasant, although not always easy, wood to cut, and its smooth surface lends itself to any degree

of polished finish. The wood varies in colour and grain, sometimes being almost as white as sycamore, and at other times approaching bird's-eye maple in its yellower tone and mottled figure.

Myrtle is a Tasmanian wood, brown in colour and with feathery figuring. It has a fine surface and, when procurable, is a favourite with fretcutters.

Oak is almost too well known to call for description, its yellow colour, long streaks and silvery markings being familiar to all. For fretwork purposes it is usually catalogued under the title of "figured oak," and nicely figured boards should always be picked if obtainable. Oak is not a wood to be selected thoughtlessly, as for many designs it is unsuitable. When articles are large enough to require $\frac{1}{4}$-in. wood then oak may (in most cases) be safely chosen. For small work, however, it must first be considered whether the strong, bold character of oak will be in harmony with the spirit of the design. On account of its coarse grain it must be cut with a sharp saw, and the work afterwards subjected to patient glass-papering. This warning may be given, as oak is a wood which, like mahogany, requires very careful finishing.

As it is fretwork, and not cabinet work, we are dealing with here the many varieties of oak need not be particularised. Apart from English oak, the American, Austrian, Riga (Russian) and Dantzig (Polish) oaks are the best known. African oak is sometimes known as African teak.

Brown oak is obtained from trees partly decayed, the acid in the wood imparting to it a rich brown colour. *Black* or *bog oak* (frequently liable to split) is the result of timber which has lain in a damp place. *White oak* is an American variety.

Olive is a favourite wood for boxes, brush backs and small frames. In colour it is a light brown, nicely veined and mottled, and, whilst hard, is easy to cut.

Orangewood is so named because of its colour. It is usually hard and close, but, as several different kinds of yellow wood of a rich and warm tone are christened orange, uniformity in grain and colour cannot always be relied on. As a rule, however, wood catalogued as orange is worth trying for overlay purposes.

Padouk is a wood which is sometimes classed under mahogany, and, at its best, is hard to beat. When perfect it is of a dark and very rich red colour. The full red boards are not always obtainable, but whenever seen they should be purchased. Some of the wood is of a dull brown colour, and the figuring varies considerably. Much of the wood is fragrant. Occasionally it is brittle across the grain, and, in cutting, the worker has to watch the unprotected parts of his fret.

Pear Tree, or *pearwood*, is familiar to those who have used T-squares and set-squares, for the making of which it is largely used. Its colour is not a useful one to the fretcutter, and as it is devoted almost exclusively to manufactured articles it is rarely procurable for other purposes.

Pine is never used for fretwork except when particularly large work, such as arches, are taken in hand. In $\frac{3}{16}$-in. or $\frac{1}{4}$-in. boards, it is too soft to cut, although for toy making it is sometimes useful. *Kauri pine*, from New Zealand, is harder, tougher and stronger than yellow pine, and is known better to woodcarvers than to fretcutters. *Pitch pine*, heavy and resinous, is not used for fretwork. *Swiss pine* is used locally for toys and carved work.

Plane Tree, sometimes richly mottled, is an easily cut yellowish-red wood. In catalogues it is usually listed in its more highly figured quality under the name of *lacewood*.

Poplar is a wood which may be used for large decorative fretwork, but not for small ornaments. Yellow in

colour, it is soft and easily cut, but is not usually listed as a fretwood.

Rosewood is one of the finest woods the fretcutter can use, but is costly. Hard, close-grained, heavy, and sometimes gummy, it is not easy to cut except in thin boards. Of a very dark reddish-brown colour, it is finely veined and figured, and its rose fragrance is pleasant. It polishes well, but a plain or slightly oiled finish is usually preferred. For ornaments which are to be overlaid it can hardly be surpassed.

Satin Walnut.—For many years this has been the ordinary fretcutter's favourite wood, and, if not the best, it has always been one of the most useful. The war greatly restricted the supply, but its popularity will in due time recover. Of a soft brown colour, sometimes richly figured, it is easy to cut, and in normal times may be had in wide boards. It has the reputation of being a wood that warps readily, but the boards imported for fretwork purposes are usually well seasoned. In America satin walnut is known commercially by the unromantic name of *gum*.

Satinwood is one of the choicest of all fretwoods. Of a rich yellow colour, often finely marked, it has a fragrant smell, and for this reason should be left in its natural state. It is hard and close in grain, sometimes a little oily, and (if expense can be disregarded) is one of the finest of all woods for small articles. For overlaying on rosewood or ebonia it is a beautiful wood, whilst for inlaying and underlaying it is one of the most serviceable obtainable. Satinwood comes from the East and West Indies, and Australian yellow woods are frequently given the same name.

Sequoia, the great *Californian redwood*, is as soft and light as pencil cedar. Its long streaks are almost parallel in their regularity, and it is one of the softest

and most easily cut of woods. Rather brown than red in colour, it looks well either plain or polished.

Silverwood (called, also, *greywood*, *harewood* and *mousewood*) is a specially stained sycamore, and, in good condition, is one of the most beautiful woods obtainable. The wood, which has a fine silvery-grey surface, is stained right through, and may be used for ordinary fretwork articles, but it is more frequently selected for overlays or for use in inlaid and underlaid work.

Sycamore, one of the most useful of white woods, sometimes resembles holly in its silky grain, while in more general usefulness it bears comparison with white chestnut. It is close and moderately hard, but is more easily cut than holly. It takes stain well, and is a favourite wood for ebonising. Much of the ebonia procurable is stained sycamore. (In the north the sycamore is known as the plane.)

Teak can occasionally be had as a fretwood, but is usually required for larger work, such as shop fronts, garden seats and gates. Its hardness and durability are well known, and its rich brown colour is appropriate for many fretwork designs.

Tulip, a beautiful wood for inlays and fancy bandings, is rarely obtainable as a fretwood. It is not unlike pencil cedar in colour, but is richer and with beautifully marked lines of varying red tints.

Walnut. — This wood is usually called *American walnut*, *dark walnut*, or *black walnut*. Dark brown in colour, its general usefulness for the larger type of fretwork article can hardly be equalled. In grain it is all that can be desired, and, whilst hard, it is not difficult to cut. Walnut takes a very pleasant dull gloss. *Golden walnut* is a wood from West Africa. *White walnut* is known in this country as *butternut*.

English walnut is a beautiful wood for plain panels

which are to be lightly overlaid. Unfortunately it is rarely obtainable. *Italian walnut*, with its richly burred figuring, can often be had in veneers. *Satin walnut* is described on page 131.

White Woods.—See *Canary*, *Chestnut* (*white*), *Holly*, *Lime*, *Maple* and *Pine*.

Yew, if procurable, will be found a finely marked and knotted wood of an orange colour. Its tough quality is well known, but it is not difficult to cut.

Of Small Fancy Woods, only rarely offered to the fretcutter, but which may be mentioned as a matter of interest, are the following :—

Amaranth, hard and of a deep purple colour ; *barwood*, bright red ; *camphor*, well known for its fragrance ; *cocobola*, a gummy red wood ; *fustic*, bright yellow ; *jarrah*, an Australian red wood ; *jasper*, purple ; *kingwood*, reddish-brown, largely used as veneer on French furniture ; *lignum vitæ*, very hard and heavy, of a dark greenish-brown colour ; *purple tree*, close-grained and hard, dark purple in tone, but without figuring ; *sandalwood*, noted for its rare fragrance, and employed for native Indian work ; *snakewood*, dark mottled brown, hard, used for walking sticks, etc. ; *tabonuco*, reddish-brown ; *thuja*, rich yellow ; *tiger*, dark brown, with strongly marked streaks ; and *zebra*, a hard and richly striped wood of the rosewood family, used for inlay bandings.

Freaks of nature occasionally throw on the market certain bastard woods which appropriate borrowed names for a season and then disappear. Many of these are singularly beautiful, and, as they are frequently well-known woods which in growth have turned a different colour, it is worth while securing them when the opportunity occurs.

The descriptions of woods just given apply to these solely as *fretwoods*, and not to their qualities or defects

in relation to cabinet-making or other branches of woodworking. Many varieties which the fretcutter will

INLAID OR OVERLAID CABINET.

Designed by the Author. *Published by "The Woodworker."*

find useful are unsuitable for cabinet work or carving, whilst others that may be used by the carver, turner or marquetry cutter are not available as fretwoods.

HOW TO FINISH WOOD

DIFFERENT WOODS—DULL GLOSSING—DULL OIL-POLISHING — WAX-POLISHING — STAINING — FUMING OAK — FRENCH-POLISHING

OPINIONS on all matters differ, but ripe experience proves that the best finish for fretted articles is to leave the wood in its natural state. This chapter is therefore a short one. There can be no doubt that the grain of finely figured panels is shown to full advantage by french-polishing, but in fretwork an unbroken surface is rarely seen. In certain cases, however, some kind of polished finish may seem necessary and the most effective methods may be mentioned.

In advance, it may be laid down almost as a rule that varnish should never be used. For large and heavy woodwork varnish is an excellent finish, but is far too coarse for delicate fretwork. The same may be said of paints and enamels. Of course, an exception is made in the case of plain toys, models, or articles of doll's furniture which have no ornamental cutting, and which may be given a fancy finish.

Different Woods.—The first thing to be borne in mind is that the colour, surface and grain of each wood must be considered on its merits. Here, too, it should be remembered that fretwork is not cabinet work, and that what is essential to the latter may be unnecessary to the former.

White woods are as a rule left plain. This applies to holly, sycamore and white chestnut, but not necessarily to maple. Pencil cedar should also be left untouched, as the delicacy of its colour is spoilt by polish. The feature of ebonia, again, is its natural dull gloss, and

although it may be well rubbed with leather, or even wax-polished, it should not be finished bright. The fragrant satinwood and any of the so-called orange woods are also best left in their natural state, especially when used as overlays. Silverwood, being an artificially stained variety, should be plain, and rosewood and padouk usually look better untouched.

Of woods commonly used by the fretcutter, mahogany is the only one for which some sort of polished finish is necessary. Those which can be treated by one or other of the different methods are beech, birch, cedar (except pencil), cherry, elm, lacewood, maple, oak, satin walnut, dark walnut, and sometimes padouk and rosewood.

Dull Glossing.—In many cases all that a piece of fretted wood requires is a dull gloss imparted by means of the glass-papering block. A wood like maple, for example, has a natural gloss when finished smooth, and this is heightened by wrapping a soft leather round the glass-paper block and rubbing briskly. Some workers, at the final glass-papering, put a little beeswax on the paper and finish off with this. Others, after glass-papering, put a touch of furniture polish (such as ronuk) on a piece of soft felt, and rub up. Woods like maple, satin walnut and rosewood receive a rich natural gloss in this way, and backgrounds for overlays hardly require any more elaborate treatment.

Dull Oil-Polishing.—This is sometimes called simply " oiling," and is a step further than the dull glossing just referred to. Dark walnut is a wood that can be improved in this way. A suitable preparation is made by mixing one part of linseed oil with three parts of turpentine. The extra quantity of turpentine hastens evaporation and prevents any appearance of greasiness. A very little of the medium is placed on a soft rag and the wood rubbed gently with this. Do not on any account soak the wood. Apply quickly and uniformly, taking care

that no part is over-stained. The surface may then be rubbed up at once, this being done by wrapping a soft piece of chamois leather or felt round the glass-papering block; or, if a darker tone is wanted, the work may be left for a few hours, lightly glass-papered and then re-oiled. The final result depends entirely on the amount of rubbing the work receives. This, no doubt, is tiring, but rubbing should be continued till every trace of oil has disappeared and a uniformly dull surface is obtained.

The effect of this oiling is not only to produce a dull polish, but to enrich the wood by darkening it.

Wax-Polishing.—This method may be tried on woods like oak, dark walnut, mahogany, maple and (in some cases) ebonia. The polish is made by dissolving bees-wax in turpentine. Yellow wax is preferable to white, except perhaps for a light-coloured wood like maple. Shred the wax and place it in the turpentine. To avoid producing a blaze, do not put it on the fire, but allow it to stand overnight. Do not have the preparation too thick; if fairly thin several coats may be given and a more uniform gloss thus obtained. Apply the wax with a rag or brush, and then rub up thoroughly as in oil-polishing. The brisker the rubbing, the better will the surface come up. Finish off with a dry cloth.

A waxed finish should not be given to work which is liable to come near water, as water at once lifts off the polish.

Staining.—The wide question of staining woods* cannot, of course, be dealt with here, and only one or two general hints can be given. Stains, liquid and in powder form, are obtainable, but the spirit stains are preferable on account of the liability of water stains to raise the grain or warp the wood. Open-grained woods have to be "filled" (see subsequent paragraph on french-polishing) to prevent the stain from sinking into the pores.

* See companion volume, "Staining and Polishing."

For this purpose many fretworkers use shellac varnish—that is, a varnish made by dissolving shellac in spirits. the work is afterwards glass-papered down to receive the stain.

Staining light coloured woods to imitate others of a darker colour is work which calls for a good deal of practice and much judgment. Without resorting to this, the worker can easily darken a wood like walnut by giving it several coats of a fairly weak walnut stain, and afterwards finishing it by oiling or wax-polishing. Oak can be darkened by repeated applications of a weak solution of ammonia.

Fuming Oak.—This favourite process can be carried out at home on small fretted articles. The aim is to expose the wood to the fumes of ammonia, but this can only be satisfactorily done in an air-tight chamber. Procure a large tin or a packing case, and make it air-tight by pasting brown paper over all edges and corners. Within this place a large saucer with ammonia, and so arrange the pieces of wood that they will be enveloped by the fumes. These have the effect of darkening the wood, which afterwards looks its best when wax-polished. If a pane of glass can be fitted to the ammonia chamber the process of the staining can be watched. The oak must be thoroughly cleaned before being exposed to the ammonia, and care should be taken not to inhale any of the fumes.

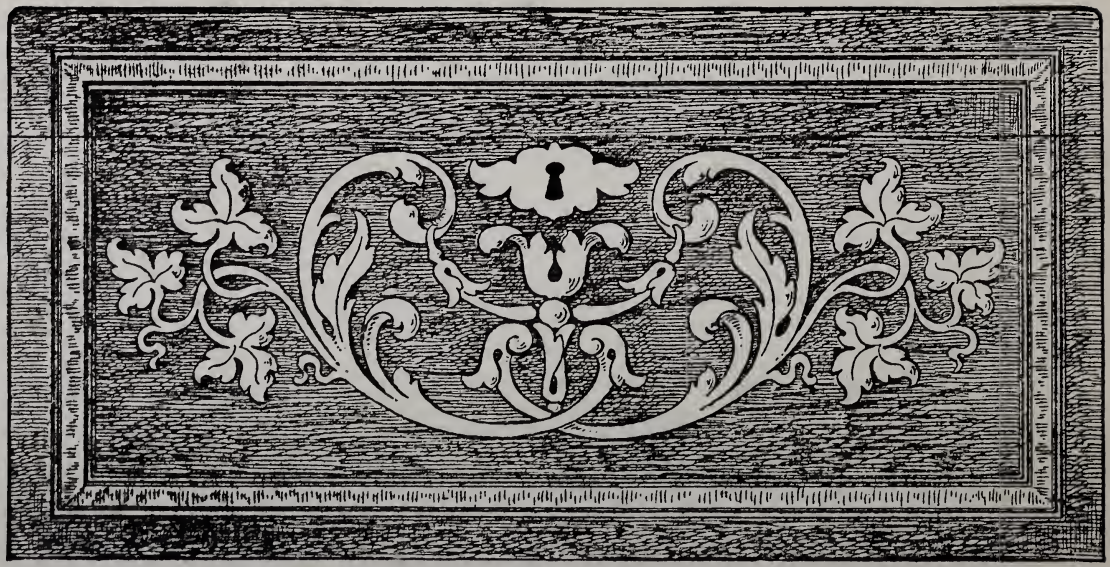
French-Polishing.—This is the method by which the highest and richest gloss can be imparted to wood, but as the fretcutter rarely adopts it except for inlaid work, a few directions must suffice. Before attempting polishing, the work must be glass-papered absolutely smooth. The first stage is "filling" the grain. Without this, even repeated applications of polish will soak into the wood and the final result will be dull. There are many wood-fillers, the most commonly used being

fine plaster of paris and water or methylated spirits. Whiting and turpentine form another common filler. Unless the worker requires a large quantity, he should buy a ready made filler. Fillers for dark woods are coloured by the addition of yellow ochre, brown umber, or venetian red in powder. On fretted work the filler will be applied with a brush, after which the work is glass-papered.

The second stage is " bodying-in," which means building up a film of polish on the surface of the wood. The polish is applied with a wad of cotton wool having a soft rag covering. It should be used fairly wet with the polish, which may be poured into a saucer, and have the wad dipped into it when charging. At first the direction taken with the rubber on the wood should be across the grain, the pressure exerted being light. A common mistake is the working of the rubber upon an over-wet surface, which picks up the film. Thus, a part once treated should be allowed a sufficient time to harden before being worked upon again. By degrees the worker will find the " body " coming up on the wood, and when a sufficiently thick film is obtained, and after ample time has been allowed for such film to dry, the work should be gone over with glass-paper preparatory to working up the surface.

The final stage, now reached, is " spiriting." The roughly made wadding or flannel rubber used for bodying-in will be discarded, and a rubber made of wadding will take its place. The rubber is covered with a piece of fine soft rag, which must be quite free from creases where it covers the sole of the rubber, and the ends of which should be pulled up to the top so as to be out of the way. For charging the rubber, a bottle, fitted with a cork having a slit in one side of it, is used, the polish being sprinkled upon the sole of the rubber from which the rag covering should be removed during charging.

With this new rubber the work is gone over, not with



FRONT OF WORKBOX, WITH INLAID OR OVERLAID DECORATION.

Designed by the Author. *Published by "The Woodworker."*

straight strokes, but, where the character of the article admits, in a series of curves. The object is to cover all the work without a break, and at the same time avoid touching any spots on which the polish has had a chance to commence to set. Should the rubber be allowed to cross its track after a few moments' interval the surface will almost inevitably adhere to it and be picked up. A little raw linseed oil is at this point introduced upon the sole of the rubber, not on the wadding, but on the rag covering. Only a couple of spots of oil put on with the tips of the fingers are wanted at a time, as too much oil results in a greasy surface.

The rubber, which should have only sufficient polish in it to moisten the work, should be applied very carefully and lightly to the existing film. With a gentle movement, exerting an even pressure, the whole surface of the article treated should be gone over again and again, time for hardening being allowed between the various applications of polish. The brilliancy of french polish is not obtained by friction and energy, as with wax or oil-polishing, but depends upon a skilful lightness of touch.

As the surface gets bright, the polish should be thinned down gradually with methylated spirit, and the use of oil should be discontinued as soon as practicable. After the work has been set aside for a few hours to harden off, a spot or two of oil should be put on the rubber to prevent picking up.

When the surface of the polish is brilliant, the direction in which the rubber is worked may be with the grain of the wood; and, there being but a few oil smears to be cleared out, the polish rubber may be put into a tin to preserve it for further use, and a rubber of wadding upon which a few drops of methylated spirit are sprinkled and over which three or four rag coverings are put, is used to go lightly over the work and remove all traces of oil. As the rag covers become dry, they are one by one removed,

and when the surface is free from oil and perfectly smooth, it may be set aside to harden and brighten, polishing operations being complete. Particular attention should be paid to this latter process, as it is very easy to mar all the previous work and make it necessary to commence operations over again.

These general hints cover only the fringe of a very wide subject, and do not pretend to be more than suggestive. With fretted work, the inside edges are first dealt with, the polish being applied with a brush ; the back is then polished, and lastly the face.

An excellent rubber for frets can be made by inserting a large flat-faced bone button in two or three thicknesses of white wadding which have been previously saturated with polish. This gives an even distribution of polish to the fretted surface, and such a rubber is less liable to catch on the edges.

When inlaid panels are composed of woods which vary in grain and colour, particular attention has obviously to be paid to the preliminary work of filling ; otherwise the woods cannot be represented in their true values.

MODEL AND TOY MAKING

LARGE MODELS—SMALL MODELS—FRETTED TOYS—PLAIN TOYS—MECHANICAL TOYS—PAINTING AND VARNISHING TOYS—JIG-SAW AND OTHER PUZZLES

MODELS and toys are favourite subjects with many fretcutters, and during the war a very large number of toys were turned out with ordinary fretwork tools. Some of the most imposing fretwork ornaments ever designed are models, and in toy making there is hardly any limit to what the fretcutter can produce.

MODELS.

Models may be divided into two general classes : (1) large objects, intended as display ornaments, which represent well-known architectural structures or examples of engineering skill, and (2) smaller working models.

Large Models are usually elaborate, made up of a large number of pieces, and entail a good deal of fitting work. The writer has had the privilege of designing many of those which are now known to fretcutters all over the world. Large objects of this kind are rarely working models ; and, although correct in proportion, and thus faithfully representing the original, the limitations of fretwood and the fretsaw prevent the introduction of minute finishing details. The aim of a fretwork model is to reproduce, say, a bridge, or a pagoda, or an express locomotive in fretwood by means of the ordinary fretsaw. The treatment is intended to be decorative rather than slavishly accurate. Numerous details may be added by the worker, but only what is

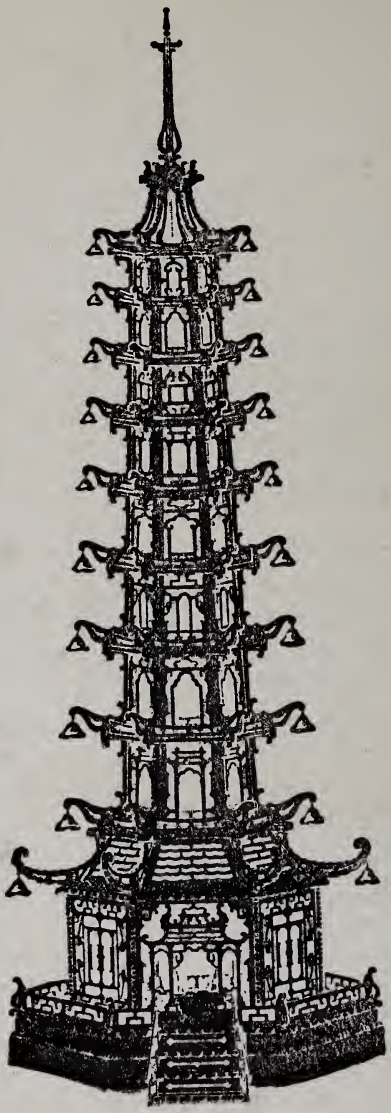


FIG. I.
MODEL OF A
CHINESE PAGODA.

Designed by the Author.

Published by
Handicrafts, Ltd.

essential to the general appearance is usually shown on the design.

These models do not differ from ordinary fretcutting

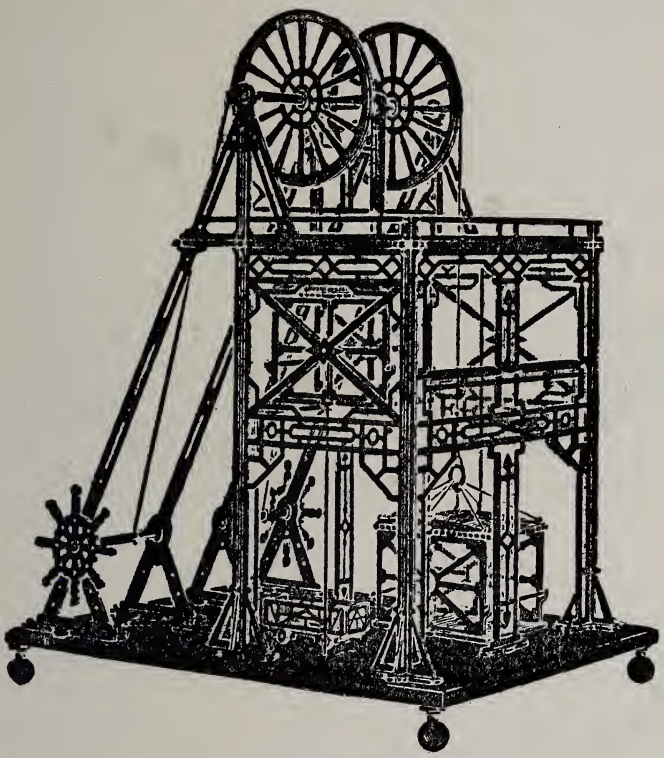


FIG. 2.—MODEL OF PIT-HEAD GEAR.

Designed by the Author. *Published by Handicrafts, Ltd.*

patterns except that, as a rule, there is less ornamental work on them. The Chinese pagoda (opposite), the Indian temple bird-cage (page 73) and the Japanese tea-house (page 150) readily lend themselves to characteristic

fretting ; but on the other hand, models like the express locomotive on page 148 and the pit-head gear on page 145 have necessarily less decorative work. The two latter are " working " models in so far as the engine and tender run on wheels and the pit cages can be raised and lowered by means of their pulleys.

Large models call for a great amount of care and patience in fitting. All constructive parts have to be carefuly tested before cut, and the order of building up must be taken methodically and with judgment. A

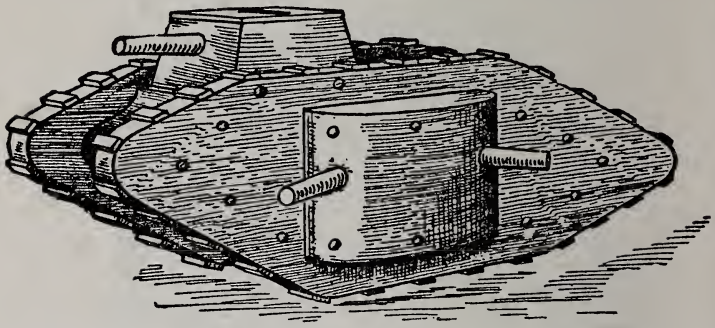


FIG. 3.—A " TANK " MONEY-BOX.

model should always be mounted on a substantial base, preferably polished. (See chapter on Backgrounds and Bases.)

Small Models, apart from their size, usually differ from those just mentioned in so far as they are plainer. There are exceptions, but as a rule the fretting is limited to what is actually necessary for carrying out the model idea. The construction calls for no special comment except that, in the case of working models, the operating parts have to be adjusted with great nicety. Many of these smaller models come under the category of children's toys, but others are in the nature of decorative

reproductions of more or less familiar objects. A clock, for example, may be a model, and a small cabinet may be a miniature representation of some large piece of furniture. Such designs, however, are not usually classified as models.

TOYS.

Fretwork toys may roughly be divided into three classes : (1) those which are richly fretted, (2) plain toys, and (3) mechanical toys. Of course, the classification is only a general one, as working toys are sometimes fretted and sometimes plain, but the terms are convenient for our purpose.

Fretted Toys.—Suggestive examples of these are sets of doll's furniture which, far from being plain, are really fretwork ornaments. There are many published sets—some simple, others more difficult—which, when cut, may be played with by older children, but which are too delicate for youngsters. In this class might also be included certain models which could be used in conjunction with a doll's house.

Noah's ark animals are very popular fretwork toys. Published designs for these may be had, but the worker can often make use of illustrations which he finds in children's picture-books. A mistake is often made in cutting these animals too thin. The most useful thickness for a small size is $\frac{1}{4}$ in., and the heavier animals look better in $\frac{3}{8}$ in. Animals should be tenoned to plinths about $\frac{1}{2}$ in. wide. In this way legs are protected from breakage. The tenon should be cut a shade long, and then glass-papered flush with the underside of plinth after it has been glued. All kinds and colours of scrap wood may be utilised for Noah's ark animals, and the pattern can often be arranged to show the grain to the best advantage. Ebonia is a favourite wood for elephants, whilst mottled lacewood is useful for lions, tigers

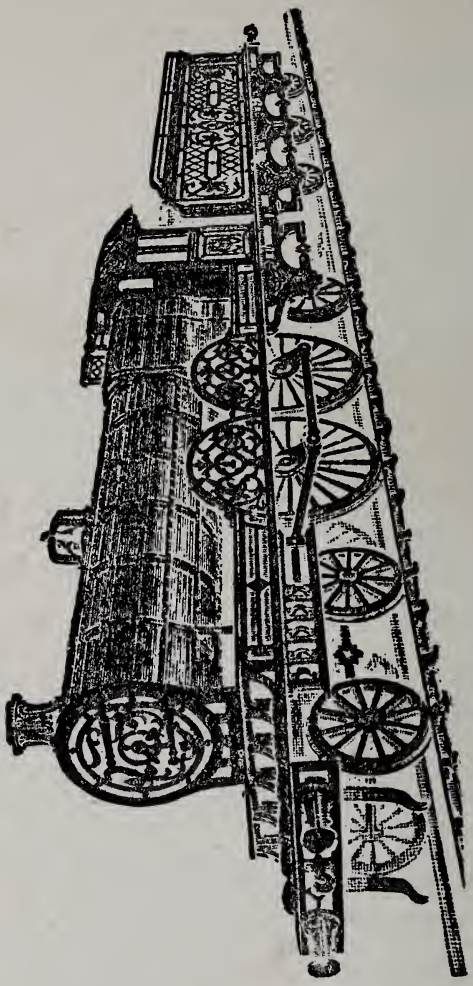


FIG. 4.—MODEL OF AN EXPRESS LOCOMOTIVE.

Designed by the Author. *Published by Handicrafts, Ltd.*

and leopards. Sets of home-made animals are frequently seen in toy stores.

Plain Toys are those where there is practically no ornamental fretting except for an occasional shaped outline. Typical examples are Noah's arks (excluding the animals), carts, wheelbarrows, and other toys familiar in the nursery. In this class might also be included jointed figures and animals, and many other

FIG. 5.—A JOINTED DOG, WITH MOVABLE HEAD, EARS, LEGS AND TAIL.

articles which, without being models, are representations of something larger. A number of these could be made without the fretsaw; but, for cutting wheels and for piercing windows and other openings, the fretsaw is the handiest tool to use. For straight work, however, the plane and shooting board will save a good deal of labour. Designs for such toys may be had, but in a number of cases simple ones can be made without a pattern.

In toy making, the worker can go beyond the ordinary fretwoods, and in many cases he uses deal up to $\frac{1}{2}$ in. or more in thickness. For large jointed animals the wood is often 1 in. thick. English cedar is a capital wood for

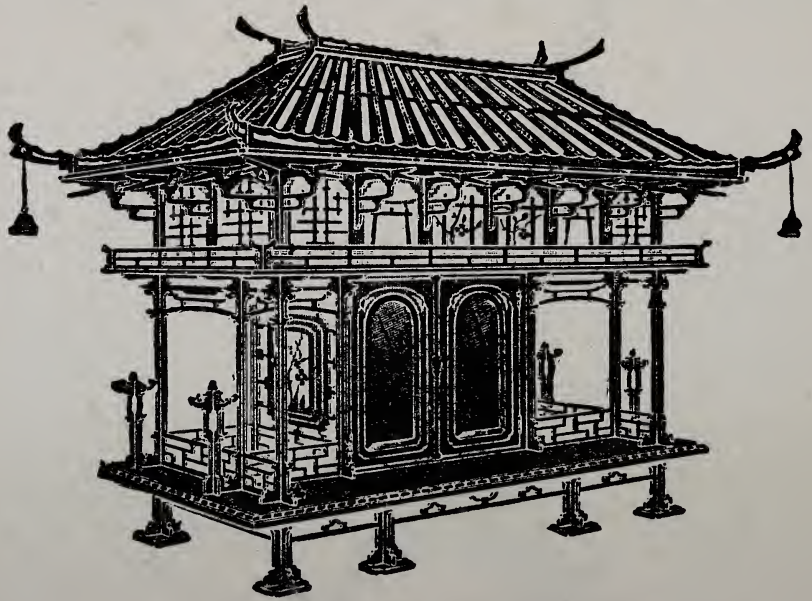


FIG. 6.—MODEL OF A JAPANESE TEA-HOUSE.

Designed by the Author. *Published by Handicrafts, Ltd.*

small toys, being fragrant and pleasant to work with; but when large objects—such as dolls' houses—are made, plain deal will be found cheaper.

Toys under this class are frequently painted, chiefly to make them more attractive to the child.

Mechanical Toys.—These are very popular, not only with children, but amongst older people. They may be said to include puzzle and mechanical money boxes, penny-in-the-slot toys, moving figures and animals (often humorous), and others which may be regarded more as playthings than models. Most of these are comparatively simple so far as the cutting is concerned, but some call for very neat adjustment in fitting. Indeed, many of the published designs are ingeniously worked out, especially when it is remembered that metal parts are rarely introduced.

Fitting.—Speaking generally, models and toys call for special neatness in fitting, and on the better class ones it is well worth while spending time over this part of the work. In the case of working models and toys, the work cannot well be shirked, as carelessness will result in some defect in the mechanical part. When toys are made for children—as they usually are—it is important to see that the wood is thoroughly glass-papered. In ordinary fretwork the edge is never allowed to get rounded, but it is wise to take the sharp edge off all toys. For decorating dolls' houses and model buildings, imitation brick and roof papers, also wallpapers, flooring, tiling, etc., may be had, and in such cases these add considerably to the effect.

Painting and Varnishing Toys.—Large fretted models should not, of course, be painted or varnished. Indeed, the wood invariably looks best when left in its natural state. The better class of toys should also be regarded as ordinary fretwork ornaments. There can be little doubt, however, that the larger type of fairly plain

toy (Noah's arks, carts, jointed animals, grotesque figures, etc.) is improved by painting, whilst other articles may be varnished.

For those who require only a small quantity, the prepared paints in tins will be found the most serviceable. Useful colours are black, white, military grey, blue, red

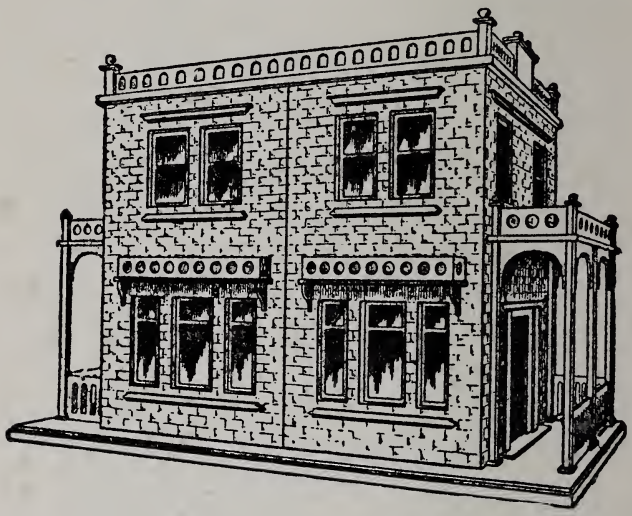


FIG. 7.—DOLL'S HOUSE.

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and yellow. By judicious mixing, other tints may be obtained. The paint, if too thick, may be thinned with turpentine—or (if in tins) otherwise as directed. It should be applied sparingly with a hog-hair brush, and care taken not to let drops gather on the edges. One coat is often sufficient, and as a glossy surface is hardly ever wanted more than two coats are rarely necessary.

When work is to be varnished, a quick-drying spirit varnish should be used. Use a small varnish brush,

dealing first with the edges and finishing with the face. Work smoothly with the grain, and avoid going over any part a second time if the varnish is beginning to harden.

Jig-Saw Puzzles are easily made by the fretcutter. For the background choose a $\frac{3}{16}$-in. close-grained wood like maple, and to this glue a coloured picture. It is better to use glue than paste, as the edges are then less liable to fray. If the wood is well roughened by scoring,

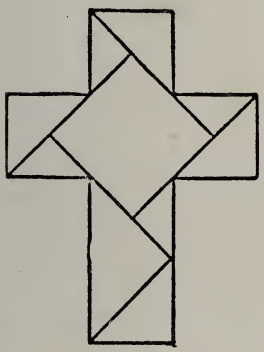

FIG. 8.
CROSS PUZZLE.

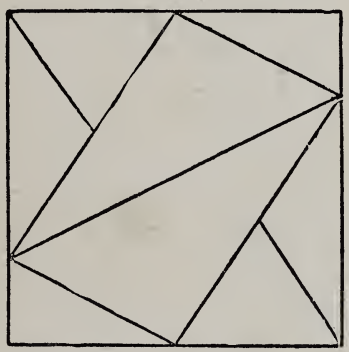

FIG. 9.
SQUARE PUZZLE.

the paper will adhere better. The panel may then be sawn into a large number of irregular-shaped pieces, care being taken that none of these have fragile projections which might break across the short grain.

Other Puzzles.—Oddments of fretwood may often be utilised by cutting puzzles of the kind shown at Fig. 8 and 9. Many similar puzzles may be schemed by the worker himself, and those shown are only simple examples. The diagrams are drawn direct on the wood and then cut as shown. To re-fit them into a cross and square respectively may afford a good deal of amusement.

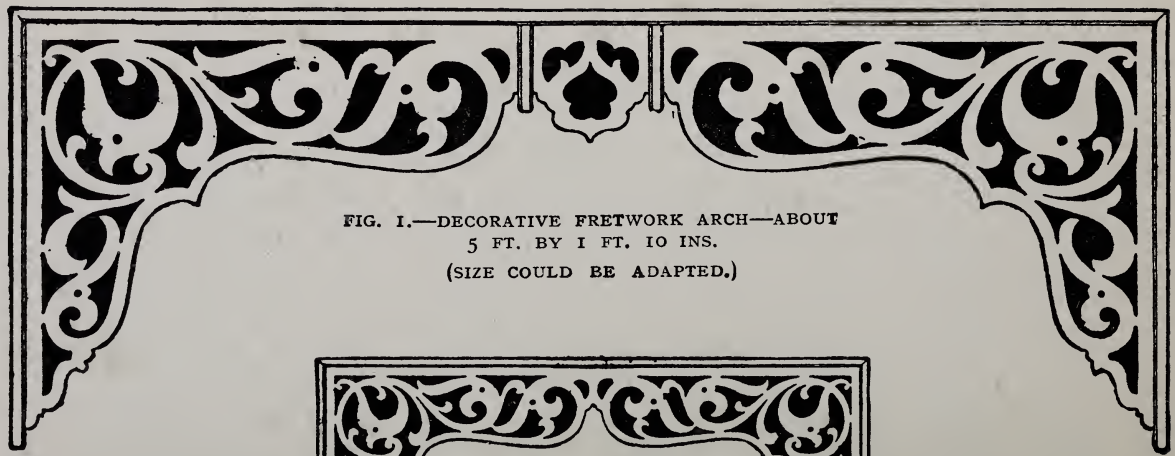

FIG. 1.—DECORATIVE FRETWORK ARCH—ABOUT 5 FT. BY 1 FT. 10 INS.
(SIZE COULD BE ADAPTED.)

FIG. 2.—SHOWING (REDUCED) THE SAME ARCH, BUT WITHOUT THE CENTRAL ORNAMENT.

LARGE SCROLL SAWING AND FURNITURE DECORATION

A DECORATIVE ARCH—RAILS AND BORDERS—ENRICHING FURNITURE WITH OVERLAYS AND INLAYS

THE home fretcutter is often prevented from attempting large decorative woodwork, not because of the lack of appliances, but simply because he is at a loss to find suitable designs. Such work is practically monopolised by the trade, designs being adopted in the workshop to suit immediate requirements. So far as the home worker is concerned, it is difficult to provide him with designs, as his wants are rarely the same as those of his fellow-craftsmen. Spaces available for decorative purposes vary in width and in height, and what would exactly suit one worker might be useless to all others except those who have sufficient of the draughtsman's skill to adapt designs to their own special needs.

The arch shown at Fig. 1 is given as an example of what may be done in large work. By plotting it into squares, a fairly skilful draughtsman could easily draw it full size. As illustrated, the arch measures 5 ft. in width—or, with the two architrave strips, added for ease in fixing, about 5 ft. 1¼ ins. The depth is 22 ins. This is a useful average size, and ought not to be beyond the ordinary worker's skill. The design, moreover, can readily be adapted if a slightly different size is wanted.

The arch, it will be noticed, is in three sections, the two main frets and a small intermediate piece. This method is adopted to avoid the necessity of sawing a very large piece of wood. Fig. 2 shows an arch slightly reduced in width by the omission of the intermediate

piece, whilst Fig. 3 shows how a doorway of about 42 ins. in width can be decorated by reversing the main frets.

Wood.—The kind of wood and the thickness used depend largely on the place to be decorated. It may be assumed, however, that pine or one of the other white woods will be chosen. As the design is not fragile, the worker need not add to his labours by selecting a hard furniture wood. Nothing over $\frac{3}{4}$ in. should ever be required, nor would heavier wood suit the design; and if the arch is to be fixed where it will run no chance of being damaged, $\frac{5}{8}$-in. or $\frac{1}{2}$-in. wood will be sufficient. Ties, it will be seen, are numerous enough to protect any projecting points. At the same time no more than are necessary for ordinary safety's sake have been introduced.

FIG. 3.—SHOWING ARCH WITH SIDES REVERSED.

Cutting.—The work may be done at home with the ordinary fretwork hand-saw, provided it has an 18-in. swing, or with a keyhole or saw-pad saw. We need not speak of the vertical jig-saw which, if possessed at home, will make cutting much easier and more pleasant. If a fretsaw is used, the finer blades must, of course, be

avoided, but a medium size will probably be found more suitable than the coarser blades. We have seen excellent work of this class done with the ordinary fretsaw, which has the advantage of turning out smoother edges than can otherwise be secured. It is desirable, as far as possible, not to *turn* the saw at any of the acute angles, but to get a sharp, clean cut by approaching the corner from different directions. In rounding a projection, too, the grain of the wood must be closely watched, as the friction of sawing is apt to result in a mishap.

Fitting.—The method of fitting depends largely on the particular place in which the arch is to be hung. If the fitment is to come under some staircase or window soffit, and to lie between wall and wall, the easiest plan is to prepare narrow architrave strips into which the frets may be tenoned. These may be of $\frac{5}{8}$-in. stuff, and from 2 to 3 ins. wide. The edges should be chamfered. To guard against atmospheric changes and their results, the tenons may fit loosely, the joins being hidden by lengths of narrow beading. As an alternative to the architrave strips, the arch may be framed at top and sides. The three sections, as seen in Fig. 1, are joined by means of short pieces, similar to the architrave strips, to which the frets are tenoned.

Arches of this description are usually finished in white. All edges must first be thoroughly cleaned, the outer ones with the spokeshave, the inner ones with glass-paper. A priming coat of red lead should then be given, this being followed with two thin coats of white lead paint. Felt down each coat after it has dried, and finish with a good flat coat. Care must be taken in painting, as the accumulation of colour in corners or on the edges badly mars the effect. If some colour other than white is chosen, three coats in all should be sufficient. If preferred, the wood may be stained, and then either polished or varnished.

OTHER WORK.

Decorative Fretwork on a fairly large scale can be done at home with ordinary tools. Of course there must be limitations as to the size and thickness of work that can be handled, but this applies to general woodwork as well as to fretcutting. It is thus unlikely that the average reader will wish to attempt very large work or require many pieces of a similar design. In workshops several thicknesses of even stout wood are cut together, but at home the fretcutter does not often wish to go beyond an inch in the aggregate.

FIG. 4.—EXAMPLES OF PIERCINGS FOR FURNITURE.

Fretted rails on fancy cabinets, etc., may be as thin as $\frac{1}{4}$ in., and will obviously be cut in the wood which is being used for the article. Shaped and fretted pediments for bookshelves, overmantels and other articles of furniture may vary from $\frac{3}{8}$ in. to $\frac{3}{4}$ in., according to the lightness or otherwise of the general design. Frequently a fret on furniture takes the form of a simple piercing, a few examples being given at Fig. 4; in such cases the

wood may be of any thickness, this depending on the particular part to be thus ornamented. For frets which are in themselves decorative woodwork, and which form no part of regular furniture, it is not customary to use the ordinary furniture hard woods, oak, mahogany,

FIG. 5.—DECORATIVE BRACKET.

walnut, etc. These are too costly and too hard. Besides, as large decorative frets are usually painted or enamelled, a cheaper wood is all that we require. Pine, canary and other white woods are used for the purpose. These can easily be cut in thicknesses of $\frac{1}{2}$ in., $\frac{5}{8}$ in. and $\frac{3}{4}$ in., and as the fret is usually out of danger's way a soft wood is strong enough for the purpose wanted.

Fig. 5 indicates a bracket which, cut to a large size, would have a fine appearance. It is designed after the style of wrought-iron work, and is shown with a shelf and back. It could, however, be used effectively as an arch fitment.

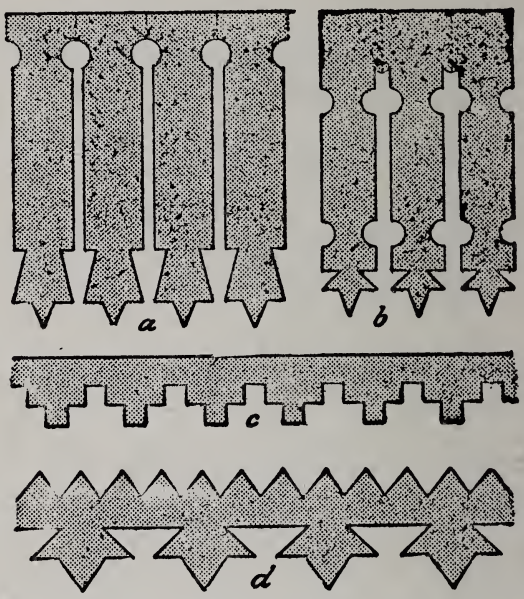

FIG. 6.—SIMPLE EXTERIOR WORK.

Rails, Etc.—For the decoration of fancy stalls at exhibitions fretted work is a simple, inexpensive and effective method of ornamentation. When arches or brackets are required for this purpose a carefully planned design must be obtained, but for top railings, drop rails, etc., a simple repeat may be worked in with remarkably good effect.

A few examples of simple but effective fretwork for

the exteriors of summer houses, porches, pavilions, etc., are given at Fig. 6.

Furniture Enrichment.—It is not always advisable for the fretcutter to interfere with existing furniture, as owing to a lack of knowledge of design he may easily introduce decoration which is inappropriate. With care and judgment, however, it is possible to enrich plain furniture and other woodwork without leaving any suspicion of vulgar elaboration. This may be effected by the application of overlays or by inlaying.

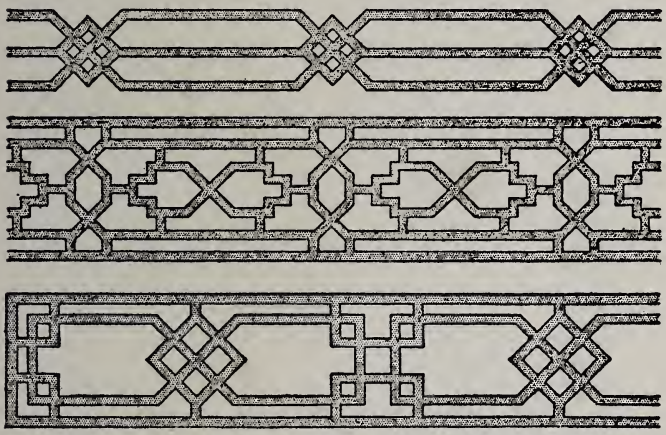

FIG. 7.—EXAMPLES OF CHIPPENDALE FRETS.

Heavy furniture does not readily lend itself to *fretted* additions, but in most cases it presents flat surfaces which could be enriched with overlays. What the worker has to be satisfied about are (1) that an overlay will improve the plain part, and (2) that he has a design that will be in keeping with the piece of furniture under notice.

Chippendale Frets can sometimes be introduced on table rails and friezes, always provided that the furniture

is of a character that will suit them. Many of the Chippendale frets are purely geometrical in pattern, being composed of straight lines. Fig. 7 shows typical

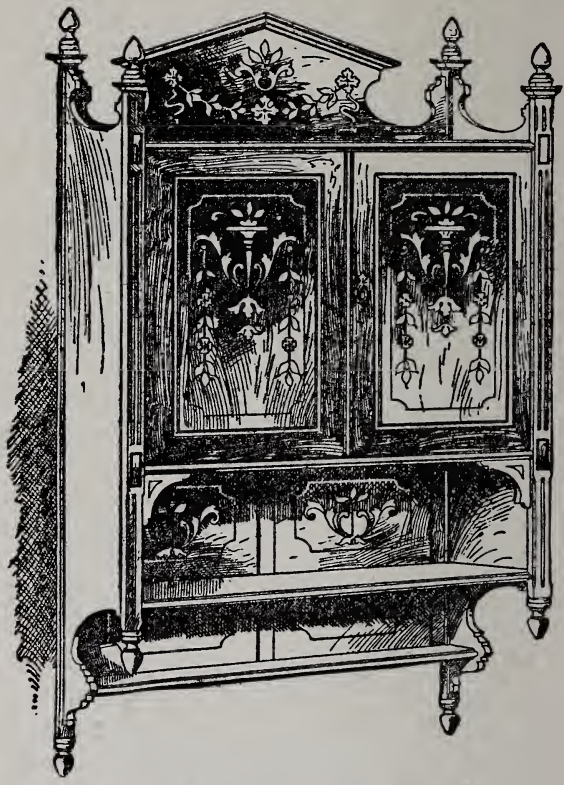

FIG. 8.—MEDICINE CABINET WITH INLAID PANELS.
Designed by the Author. *Published by "The Woodworker."*

examples of these, and the diagrams may be drawn direct on the wood by any one who has a T-square and set-square and knows how to use them. In some

designs curved lines and semi-circles are introduced, but as the freehand curves which make up the pattern are repeats, they may be traced off with transparent tracing paper after the first one has been drawn.

A Chippendale fret, from 2 ins. to 3 ins. wide, cut in $\frac{1}{8}$-in. wood and superimposed on a frieze is very effective. Then again, as a gallery to some bracket or cabinet, an open fret in $\frac{1}{4}$-in. or $\frac{5}{16}$-in. wood looks well.

Inlaid additions to furniture entail much more work, usually involving the temporary removal of panels. Fig. 8 is an example of what might be attempted by the advanced cutter. The panel borders have inlaid box or satinwood lines, whilst the delicate ornament is of the "Pergolesi" style used on richly inlaid "Adam" furniture. On a small panel the design lends itself equally to overlaid treatment.

The inlaying of fancy stringings and bands is dealt with on page 218.

The fretsaw, it may be mentioned, is a useful tool for cutting mouldings (such as cappings) when they have to be returned at the ends in the solid.

THE ART OF OVERLAYING

ADVANTAGES OF THE OVERLAY—MATERIALS—WOOD—XYLONITE — METALS — CUTTING — GLASS-PAPERING — GLUEING

ONE of the special phases of the development of fretwork within the last ten or twelve years has been the introduction of the overlay as a permanent feature in fretwork designs. Twenty years ago the overlay may have been known, but then only as a crude novelty. Its practical and artistic advantages have since been discovered, however, and now there are few fretcutters who have not known what it is to finish a piece of work which is ornamented with some beautiful overlay.

Advantages of the Overlay. — The appearance of the overlay on modern designs was first noticeable as a feature in construction. It was introduced on photograph, mirror and picture frames, taking the place of a moulding for providing a rebate. It was employed, also, as an ornamental covering for some joint where, for instance, background parts were too large to be sawn in one piece and had to be cut in two sections. As its decorative qualities became more apparent it began to be treated as an ornament pure and simple.

The advantages of the overlay are twofold: its constructive use and its artistic value. In endless ways it may be used to simplify the fitting together of an article. Many fretcutters are inexperienced in general woodworking, and have to rely solely on the simple methods of construction indicated on the design. An overlay on a photograph frame not only improves the article, but obviates the necessity of providing a back

framework which might be heavy and clumsy. On an inkstand an overlay rim for holding the ink-well in

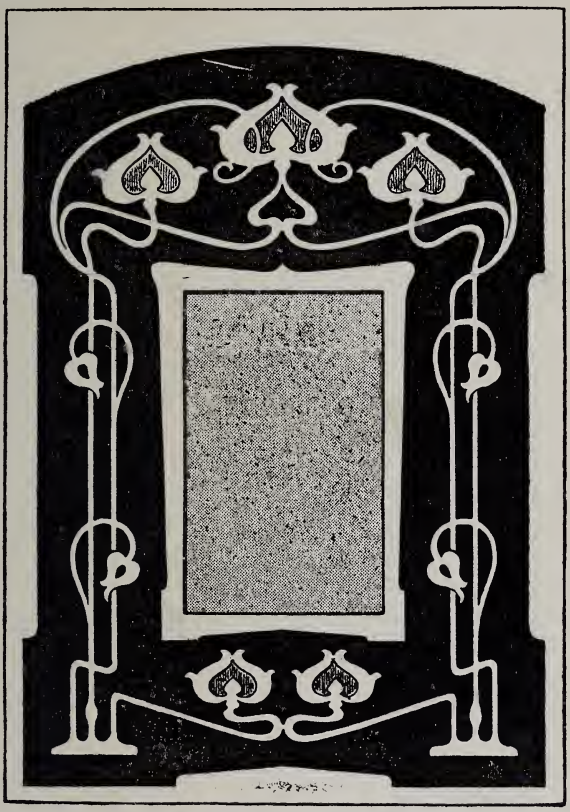

FIG. I —OVERLAID FRAME.

position saves a more elaborate fitting. The mitreing of a fretwork picture frame is made easier if there is a decorative overlay to hide the angle joint, and in many other ways the applied ornament may be introduced to

save the worker from woodwork fixtures with which he is unfamiliar.

On the artistic side, again, the overlay may often be a great improvement. Its possibilities are endless, and only a few examples need here be given. On panels of small cabinets, on box lids, and as an ornamental treatment for other plain surfaces it may be used most effectively. Three of its special advantages in this way may be mentioned: (1) the variety it affords from the ordinary fret, (2) the fact that it provides a relief ornament, and (3) the provision it makes for permitting a contrast in colour which could not otherwise be obtainable.

Variety.—On the first of these points there is no doubt that many art craftsmen dislike fretted work not only because the finished fret is in the nature of a flat silhouette, but because the pattern itself is too flowery and inter-cut. By means of the overlay this objection is overcome. The background may be perfectly solid, its graceful effect being obtained by means of an artistic outline. There will be no interior fretting; the edge alone will have been cut. The decorative feature is the overlay. This may be a comparatively simple spray which, although perhaps too plain and open for ordinary fretwork treatment, is eminently suitable for an applied ornament.

Relief.—Then, again, the overlay relieves the flatness of fretted work. It is not, of course, intended to represent carving. It is intended for nothing more nor less than it is—a delicate fret mounted to a solid background. It is not meant to appear as if it were part of that background. It is—as it is intended to be—applied. In this way much can be achieved in fretwork that could never be achieved before. A beautiful and fragile fret, which under ordinary circumstances could only exist if preserved under a glass case, can be cut, and, when fixed in position, will be as secure as its

background, and yet will retain all its origina delicacy of design.

Colour Contrast.—The third advantage is that a contrast in colours is obtained. While it is permissible in some cases to use different woods for a fretwork article, the mixing up of colours is not generally recommended

FIG. 2.—SKETCH LANDSCAPE IN OVERLAY.

But as the overlay is relief decoration a contrast in colour is desirable. At the same time, the use of different woods is not necessary. A white background usually looks best with a white overlay; but when the background wood is dark, a far finer effect can be obtained by the use of a lighter colour for the applied ornament.

It does not, of course, follow that only one wood for the overlay is to used. Indeed, *inter-overlaying* is now

one of the recognised features of advanced fretwork—inter-overlaying being (like inlaying) the employment of woods of different colours. It is never advisable in inter-overlaying, however, to introduce the same variety of colour that may be permissible in inlay work. The inlay is essentially a pictorial form of decoration, and when the surface is afterwards polished the ornament is softened by being blended with the background. The overlay, being in relief, is more prominent, and may easily be made unbearably obtrusive if too many colours are used, and if these colours are in too violent contrast.

MATERIALS FOR OVERLAYING.

The materials usually employed for overlaying are wood, xylonite in various colours, brass and aluminium. To these might be added copper, pewter, silver, ivory, vulcanite and slate. Real mother-o'-pearl and tortoiseshell have occasionally been used for overlaying, but more often as inlays or underlays. In actual practice it is exceedingly rare to find silver chosen by the fret-cutter. Unless used in a very thin sheet its cost is prohibitive, and when thin it does not look well. For the same reason pure ivory is hardly ever taken, more especially as white ivory-grained xylonite is an almost perfect substitute. This also applies to tortoiseshell, while with regard to vulcanite there is no special reason why this material should ever be selected. If a black overlay is wanted, nothing looks better than ebonia wood. Mother-o'-pearl is rather brittle for delicate applied work, and there is no satisfactory substitute.

Wood.—For overlay work great judgment is required in selecting wood which is thin enough. When overlaying first began to grow in popularity, the tendency was to use wood which was too thick, with the result that the applied ornament looked coarse and heavy. Obviously, the thickness must depend on the size and

nature of the general work, and also on the character of the ornament itself. It may be laid down as a safe rule, however, that $\frac{1}{16}$ in. is the average thickness. Very delicate overlays on miniature work require less; bold and large work may want $\frac{1}{8}$ in.; but the recognised medium is wood of $\frac{1}{16}$ in.

The overlay, although relief ornament, is not modelled, as in carving. It is applied decoration on the flat—

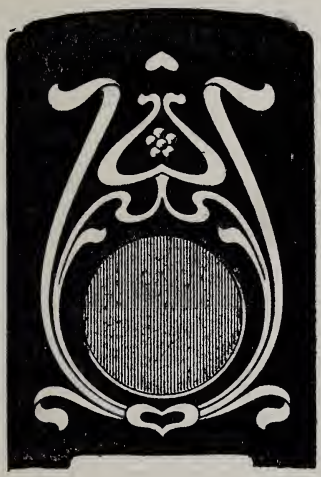

FIG. 3.—OVERLAID PHOTOGRAPH FRAME.

a silhouette, beautiful in its mere outline simplicity, which would be spoiled by any interference on the part of carving tools. It is, and is intended to be, a fret, and its finished grace depends on (1) the design itself, (2) the thickness and colour of wood, and (3) the skill and spirit shown in cutting, and the care in fitting.

Special boards, saw-cut, are sold for overlaying, one side frequently being left rough in order to facilitate glueing. Obviously a hard and compact wood, without

elaborate figuring, is most suitable for an overlay, and a few of the favourite kinds may be mentioned.

Of the white woods, holly, sycamore, white chestnut and white maple are the favourites. Holly is the purest of all, and its ivory-like grain makes it justly popular. Closely approaching it comes sycamore, with its mottled silky surface. Maple is perhaps more useful, although not quite so white. It has a fine, hard and even grain, and the natural gloss which comes to it with a little rubbing renders it less easily soiled. It has the additional advantages of being amongst the cheapest of all woods, and of invariably being procurable in excellent quality. Of yellow colours, satinwood is the best. Of medium woods may be mentioned pencil cedar, unfortunately difficult to obtain, and the favourite stained grey, green and red woods manufactured from maple or sycamore. The best dark woods are padouk and rosewood, while, as a substitute for ebony, the fine stained black wood known as ebonia may be taken. Almost any of the ordinary fretwoods may be had in overlay thickness, and the above is only a selection from a long list. White and light-coloured overlays always look well, no matter what the background may be. It is when a dark wood is to be chosen that the worker requires to consider well the question of contrast, as a dark overlay on a light ground has always a tendency to look heavier than if the colours were reversed. If, again, a very dark wood, such as ebonia or rosewood, has been taken for the background, the character of the design must determine whether an overlay of medium colour will look better. One of the most handsome results is had by overlaying white xylonite on a black background, but it does not necessarily follow that any design cut, say, in dark rosewood will stand a white holly ornament.

Xylonite, before the war, could be bought for about two shillings or half-a-crown per square foot, but at the moment of writing its price has very considerably

advanced. Its thickness is measured in $\frac{1}{100}$ths of an inch, and the most useful thickness for small work is $\frac{1}{25}$ in. The grain is compact and uniform, easy to cut and not brittle. It is usually cut between two thin boards of wood, although some workers prefer to use only one board below. Xylonite may be bought plain, polished one side only, or polished on both sides. It is better to have one side matt, as in this way it is more readily cemented to the wood.

White xylonite is by far the most useful colour. Great care, however, should be taken to use only that known as "ivory grain." There are inferior xylonites on the market which, when cut, look merely like cardboard with a glazed surface. The grain of good xylonite is the same through and through, and when a sheet is bought the edge should be examined. If it looks like ivory or bone it is right; if it looks like cardboard it is inferior. Ivory-grained white xylonite, if used not less than $\frac{1}{25}$ in. thick, has all the appearance of real ivory. If preferred unpolished the surface may have a rub with fine glass-paper.

Of coloured xylonite there is a large variety. The pale shades of heliotrope and uncertain blues and greens may be ignored, but deeper reds, greens and blues are occasionally useful for inter-overlaying and underlaying. The so-called "art" shades should never be used, not because in themselves they may be ugly, but simply because they do not go well with wood.

Marbled, tortoiseshell, mother-o'-pearl and other xylonites are also procurable. Of course they are imitations, but many of them are wonderfully good. The figuring makes them unsuitable for very fine overlays, but for underlaying they are most useful. The mother-o'-pearl sheets lack the brilliance of real pearl, but are pleasing in themselves. The varieties known as golden marble and tortoiseshell are also most serviceable for small underlaid parts.

Xylonite may be fixed to wood with ordinary glue, or one of the good liquid glues sold in tubes, or the special xylonite cement may be used. Perhaps its one real drawback is that it is inflammable. It should never come near a light, for if a large sheet caught fire the extent of the flame would be a serious danger.

Metals.—It is a common mistake to use those too thin, and although stouter metal is harder to cut the finished appearance is worth the extra trouble. The gauge to select is, roughly speaking, from $\frac{1}{32}$ in. to $\frac{1}{25}$ in. Sheets should be had polished on one side.

Metal has to be cut between two boards of wood, holes being drilled for the nails. It is important to have all tightly fixed, any lack of rigidity increasing the labour. To lubricate the saw it is customary to grease two sheets of thin paper and place these between the wood and metal.

Aluminium, *brass* and *copper* are all suitable for overlays. Aluminium is very light, but on account of its texture it requires careful treatment. Copper is softer than brass, but is firm, and needs to be well sandwiched between the wood boards. Pewter is also occasionally used.

As a rule metal overlays look better when they can be fixed with small round-headed brass or nickelled screws. The design may not always provide for this, however, in which case shellac cement, sold in sticks and applied by heating, may be used.

Slate.—It might be mentioned that slate (although not a metal) is largely used in Welsh districts for fret-cutting. It cannot often be had less than $\frac{1}{8}$ in. thick, but on fairly bold work the effect as an overlay is much finer than might be expected. On account of its brittle character special precautions have to be taken in drilling and cutting. It is usually cut by glueing between two boards of wood, the latter afterwards being removed by steeping in water. After glass-papering, a good finish

may be had by rubbing up with French chalk on a soft pad.

CUTTING AND GLUEING.

The Cutting of overlays must be carried out not only with care, but with spirit. The mere fact that the ornament is in relief, and that it is probably in a lighter colour than the background, gives it greater prominence, and makes it all the more necessary to have the workmanship perfect. The glass-papering must be such, too, that no threads of grain are left on the edges, and in fixing it must be seen that no traces of glue are allowed to creep on to the background. These are all matters that call for ceaseless attention; for, however artistic may be the design from which the craftsman works, its true beauty can only be reproduced if care and taste are exercised alike in the selection of suitable materials, and in the cutting and finishing of the ornament.

For overlay work fine saws are necessary, partly because the work is usually more delicate and partly because the friction of a coarse blade is too heavy. The cutting is, of course, done in the usual way; but in sawing some delicate twig, where the fragile part is across the weak grain, great care must be taken to go smoothly. The upward stroke of the blade is apt to break the thin wood, and although a break may not be fatal it is not always easy to repair neatly.

Wood of $\frac{1}{16}$ in. cannot be cut alone. It is too thin, and requires support. The usual plan is to cut two or more pieces at once, and if this is not done, a waste board of about $\frac{1}{8}$ in. should be fixed on below. Xylonite and metals are cut between two pieces of wood, but this is not really necessary in the case of wood overlays unless, perhaps, the ornament is being cut in white and is extremely delicate. It is often a good plan to glue a piece of tough but thin paper over the back of the overlay

wood. This prevents the accumulation of ragged threads on the underside ; it also saves some fragile point that may, in the process of glass-papering, happen to receive too hard a knock, the paper preventing the injured part from breaking away. This paper should be glued, not pasted, as it is not afterwards removed, but receives the glue which fixes it to the background. Xylonite is treated by some workers in the same way.

Glass-papering.—It is after an overlay has been cut, and before it has been mounted in position, that its fragile character is appreciated. Still, delicate though it may be, it has to be glass-papered thoroughly before it can be regarded as finished. This operation may be done either before it is glued in position or afterwards. In either case, however, every trace of raggedness on the edges must be removed, either with a fine file or with a narrow strip of glass-paper. Threads of grain cannot be properly removed after the overlay is mounted, and on no account must even a tiny wayward fibre appear on the completed work.

The back of the overlay, too (whether paper has been glued to it or not), must be gently glass-papered in order to make sure that there is no roughness on the edges. The best way of doing this is to put the delicate fret back into the waste margin of wood from which it has been cut, and glass-paper it thus. The front surface may, if desired, be dealt with in the same manner.

Glueing.—Before glueing, the worker should make sure that his means of pressure is ready. The secret of lasting strength is that the work is cramped up or laid under a weight immediately it is glued. If a small sheet of plate glass is handy, this may be used to place on the work, when—should the overlay slip—the fault may be detected before it is too late.

Also, before glueing, the exact position of the overlay should be carefully marked on the background. A

capital plan is to lay it temporarily on the background, and close up at, say, three corners pass in fine pins. These act as a guide on which the overlay will slip up and down. When it is ascertained that, with the aid of these guiding pins, the overlay will drop exactly into its correct position, remove it and glue it.

Beginners often find a difficulty in placing their overlays in the correct position. In most cases, however, the position is indicated by dotted lines on the diagram ; and if, after pasting the pattern to the wood, a few points are pin-pricked, these will serve later as a guide when glueing the overlay.

Prepared liquid glue is the easiest to use. Different workers apply it in different ways, but the important point is to give enough of glue to hold the fret firmly, yet not so much that any surplus will get squeezed out from under the edges when pressure is applied. Glue, of course, will not adhere to a polished ground. Sometimes the overlay is strengthened with pin points. These are cut off about $\frac{1}{4}$ in. from the point and the blunt end forced into the background with a pair of pliers. When the overlay is afterwards pressed into its place these hidden pin points assist the glue in giving it a firm hold.

Should any trace of glue appear on the overlay edges or the background, this is more easily wiped off with a rag before it hardens. If it is not observed till afterwards it may be carefully removed with a sharp penknife when the glue is hard and brittle.

Plain rectangular overlays for small frame openings can be made from fancy inlaid bandings about $\frac{3}{8}$ in. wide. These are cut to length in four strips ; they are mitred at the corners and glued on so that they overlap the opening in the usual way.

ADVANCED OVERLAYING, MINIATURE FRETWORK, CUTTING XYLONITE AND METALS, UNDERLAYING

DOUBLE OVERLAYS—OVERLAYS ON FRETTED GROUNDS—INTER-OVERLAYING — MINIATURE FRETCUTTING — CUTTING XYLONITE — CUTTING METALS — FIXING AND FINISHING METALS — UNDERLAYING — BACKING — JEWELLING—PICTORIAL OVERLAYS

BY ADVANCED OVERLAYING is not necessarily meant that the actual work is more difficult, but rather that it presents problems from which the simpler forms of overlay work are free. It may mean that double overlays are used ; that a fretted overlay may be superimposed on a fretted ground ; that several different colours of wood are used ; that parts of the overlay are lined or underlaid ; that pictures are reproduced in wood ; or that the work is very small and may be carried out in metals, xylonite, or other material.

Double Overlays are introduced for different reasons and in different ways. The simplest example is that of a mirror or picture framed with two overlay rims (see page 109). A second example may be seen at Fig. 1. The front of the hand mirror (right hand) has a single overlay which holds the glass. The back (left hand) has two overlays. The lower one corresponds in outline with the front overlay, but is practically solid and has a second overlay mounted on it. The upper overlay would in this case probably be cut in xylonite or metal, as the material requires to be very thin.

When double overlays are used in this way the question of thickness is very important. If the material is thick and the article small, a heavy effect is produced. In the case of Fig. 1 nothing over $\frac{1}{16}$ in. could be used for the larger overlay, whilst $\frac{1}{32}$ in. would be ample for the smaller upper ornament.

FIG. 1.—HAND MIRROR, WITH SINGLE OVERLAY ON FRONT AND DOUBLE OVERLAY ON BACK.

For cabinet doors a delicate overlay is sometimes mounted on a thin panel with shaped corners, this being used as a raised panel for the solid door. Frequently, too, an overlay has a shield or other central form, on which is superimposed a small device or monogram.

Overlays on Fretted Grounds are not often met with, and when introduced it will usually be found that the fretted background is of a geometrical character. Fig. 2 is more suitable for carving than fretcutting, but it is a design which has also been used for overlaying, the ivy leaf spray being cut as a thin overlay and mounted on the open trellis background, the whole afterwards being backed with a thin board of a darker colour. A good deal of care has to be taken in glueing, and obviously the work is not of a character that can be viewed from behind if the fret is left open.

FIG. 2.—OVERLAY ON A FRETTED GROUND.

Inter-Overlaying.—This term is often applied to all overlays for which different colours of wood are used ; but, more strictly speaking, it means the interlaying of two or more woods in a design such as Fig. 3. This is a severely geometrical example, but is a good illustration of interlacing. By ignoring the intersecting lines, the pattern can be cut complete from one piece of wood, and in this way as an overlay would look quite well. But if the design (which is somewhat of a maze) is followed, it will be found that there are two distinct patterns. The central square is one device, and could be cut in

one wood; whilst, if the rest of the design is followed, it will be found that there are four corners which, in tortuous fashion, interlace with the other part, and for which a second wood could be taken.

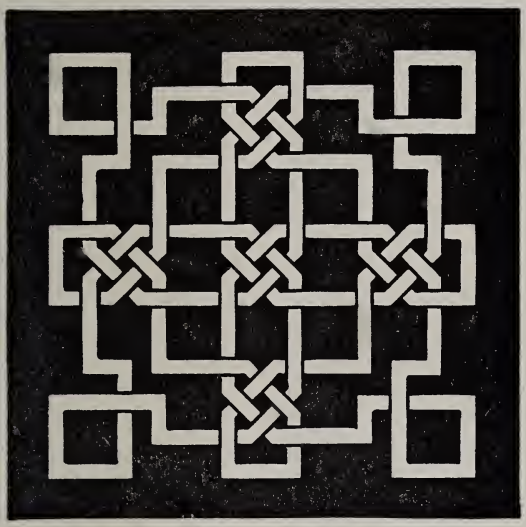

FIG. 3.—INTERLACING OVERLAY.

The two boards would be cut together, but the illustration is not given as a working example, the task of correctly arranging and glueing the different parts being far from light.

Inter-overlaying bears some resemblance to inlaying. The chief difference is that the complete ornament itself, although made up of intersecting or interfitting parts, is glued upon, and not laid into, the background. This makes overlaying of any description always easier than inlaying. At the same time, the different woods of a varied coloured overlay often fit so closely that only the

FIG. 4.—OVERLAY IN THREE OR MORE WOODS.

FIG. 4A.—OVERLAY IN TWO OR MORE WOODS. (DESIGN COULD BE USED FOR INLAYING.)

inlay method of cutting will give satisfactory results; sometimes a portion of an overlay has a piece partly inlaid into it although the whole cannot be termed a real inlay. Fig. 4, for example, may be made up of three or more different woods, these having to fit so closely that it will be almost necessary to cut all three boards together.

Fig. 4 could easily be cut in three, four, or even more woods—say, a combination of white and yellow for the flowers, a delicate brown wood for the leaves, and silver wood for the stems. The butterfly and ribbon could be cut from a piece of mother-o'-pearl xylonite. Fig. 4A is a good example of a two-colour overlay.

Many inter-overlay designs are much more elaborate than this, and some are further enriched with underlays. A mistake that the worker has always to guard against is in introducing too much colour. While a touch of variety enhances the design, injudicious colouring is apt to vulgarise it. It is of great importance to have the general contour of the design brought out in one colour, and when subsidiary features are picked out for separate colour treatment it must be seen that these are not made glaring.

MINIATURE FRETCUTTING IN WOOD, XYLONITE AND METAL.

What Miniature Work is.—Miniature fretwork is sometimes ordinary fretwork in so far as the article is made up entirely of frets. The difference is that the material used is very thin wood of a hard kind, or metal, or xylonite. More often it represents an overlay, or series of overlays, cut in delicate wood, ivory or metal, and mounted on a background which is either solid or lightly fretted. Underlaying and inlaying, too, are frequently combined with overlaying.

As an example of the first class may be mentioned the delicate ivory models of temples, etc., made so frequently

by Indian craftsmen. Much of the work is in this case done with the file, but, given suitable designs, it could all be carried out with the fretsaw. The illustrations shown here are typical examples of miniature overlays mounted on a solid groundwork, in these cases the delicate frets being protected by their backgrounds.

FIG. 5.—INDIAN ORNAMENT.

Fig. 5 is an example of a very fine Indian overlay. It is, of course, reduced in size, but in a diameter of about 6 ins. it would make a beautiful centre ornament. Fig. 6, a design for the cover of a leather-bound book, is given full size. It could be carried out in metals or in ivory xylonite. Any initials may be placed in the central panel. The pattern is equally suitable as an overlay for a box lid or door panel.

FIG. 6.—OVERLAY DESIGN FOR BOOK COVER.

Designed by the Author. *Published by "The Woodworker."*

Cutting Xylonite.—The materials for overlay work—wood, xylonite and various metals—have already been described, and the cutting of thin wood has been adequately explained. When we come to xylonite, we are dealing with a material which has usually a highly polished surface. It may, of course, be used unpolished, but in this state rarely looks to full advantage. Unpolished white xylonite has a beautiful surface, but one which is readily soiled. When both sides are to be seen both are polished; but, when xylonite is used as an overlay only, a sheet polished on one side and finished matt on the other is usually taken. A single piece is usually cut between two protecting pieces of wood. If there are two or more pieces, a thin protecting board on the top is sufficient. Being a manufactured material it has no erratic grain, and in this respect is tougher and less apt to break than wood. It is usually employed thinner, however ($\frac{1}{25}$ in. being the average for overlays), and as it is thus more pliant it requires to be held securely. The chances of breakage are few, and if the saw is worked smoothly there is little risk of rough edges, but it is of the utmost importance to have the xylonite tightly pressed between the two boards. If there is any play, the saw will leave a ridge on the upper edge which it is very difficult to get rid of. Prevention in this case is much more satisfactory than any cure. A sheet of thin and soft tissue paper may, if thought desirable, be placed between the xylonite and the upper board to protect the polished surface. Oil or grease should never be used for lubricating the saw. It is not required for xylonite.

It will be found that, if the material has been tightly held between its protecting boards, there are no rough edges to receive attention. Any burr on the underside may be levelled by a sharp rub with a stiff leather. Both surfaces may afterwards be rubbed with a soft leather. Any marks, the result of soiled

fingers, may easily be removed with a little soap and water.

When stouter xylonite—say, from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. thick—is used, the protecting boards may be very thin.

No worker should make use of xylonite without knowing that it is an inflammable material. On no account must it be held near a light or fire, and smoking should be postponed until it is out of sight.

Manufacturers who make use of xylonite for fancy articles have a special cement for fixing it. As a rule, the fretcutter finds that strong glue is sufficient for his purpose, but this holds better if it is mixed with a little methylated spirits.

Cutting Metals.—Coming to metals, such as brass, aluminium, pewter and copper, the materials here are so hard that there is little risk of the worker losing control of his saw. For other reasons, however, it is still necessary to have the metal sandwiched between two boards. The probability of metal for miniature work being used so thick as to be practically rigid is so remote that we need hardly consider it. Boards, in metal sawing, are not used so much for protective purposes as to make cutting easier. They increase the weight of material to cut through, but the advantage of smoother and more pleasant sawing more than compensates for this. The hardness of metal, and the consequent resistance it offers to the saw, are apt to cause it to jump from the cutting-table unless firmly held down, while its natural spring and yielding qualities occasion so much "give" that any attempt to cut an unprotected piece will probably result in an irregular surface, rough edges, many broken saws and a bad temper. When securely held between two boards the metal remains quite flat. Play is avoided, the rasping sound is deadened, and although there is the same hard material to saw, the work is really easier, and on both surface and edge a more satisfactory result will be evident. The pattern, too, is transferred to the upper

board. It is not desirable to have it pasted direct to the metal.

Unless very thin metal is being cut, it is usual to adopt some means of lubricating the saw. An occasional drop of oil on the blade is of little use here, as the lubricant gets absorbed after a few strokes. A better plan is to grease two sheets of thin paper with tallow and place these between the metal and the wood. The blade in this way is automatically lubricated.

Special saw-blades, with teeth pretty close, are made for metal cutting. Ordinary fretsaws, however, may be used if the others are not readily procurable. Saws 00 and 0 are rather delicate for this hard work, and a No. 1 has usually to be taken. We believe the majority of workers agree that the hand-frame is better than the treadle machine for sawing metals. Great care is required, however, to maintain a smooth and regular stroke.

If the edges are rough, which ought not to happen with careful cutting, or have a ragged burr, the file may be resorted to ; but in many cases a rub with a stiff piece of leather is sufficient to give a smooth surface. Smoothness is necessary, however, as any trace of the sharp burr will mar the whole effect.

We have made no special reference to drilling, as this is done in the same way as in larger fretwork. As designs are fine and the work close, fine drill points are necessary, and care should be taken not to let the drill trespass on the outline.

Fixing Metal Work. — As metal ornaments are usually cut for overlays, the worker is not troubled much with constructive details. Metal overlays cannot, of course, be glued, but are secured with brass pins or round-headed screws. Shellac cement (procurable in sticks, like sealing wax) is sometimes used when the design permits of neither pins nor screws. The metal

in this case should be warmed before the cement is applied.

If an article is being made in solid metal, and if tenon joints are required, the tenons should be cut with two little projections which (after the parts are fitted together) may be bent back. The little projections thus act as rivets.

FIG. 7.—DESIGN FOR HAT-PIN HEAD (CUT IN WOOD, WITH METAL OR XYLONITE OVERLAY).

Finishing Metals. — Polished brass is usually procured by the home fretcutter. If polishing is necessary, the process is to rub the surface with very fine pumice stone (or, instead, charcoal and water), and then polish with rottenstone and either oil or spirits of turpentine. Polished brass may be finished with very fine emery cloth and a touch of oil.

To lacquer brass, purchase a bottle of pale gold lacquer (costing sixpence) and a fine flat camel-hair brush. The lacquer is applied as a varnish. It must be used sparingly, the brush being drawn lightly and quickly over the surface so that no streaks are left. No second coat should be given until the first has thoroughly set. The metal must be perfectly free from dust or grease, and should be slightly warmed before the lacquer is applied. If any

part is not done properly the lacquer must be removed with spirits and the surface gone over again with the brush.

If the brass is gilded instead of lacquered, care must be taken not to put on the gilt too thickly A matt gilt finish has a very pleasing effect.

Aluminium is a metal that does not require a high polish. When a fairly bright finish is wanted any good make of metal polish may be rubbed on with chamois leather, the surface afterwards being varnished with transparent lacquer.

UNDERLAYING.

An Underlay is a piece of coloured wood *inlaid* into a background in such a position that it forms a backing for some particular feature of an overlay which is to be glued on above. Inlaying is described in a subsequent chapter, but as underlaying is used in conjunction with overlaying, the method may be dealt with here.

At Fig. 8 are shown the lid and one side of an overlaid box. (The ornament shown is equally suitable for inlaying, but for the moment we will regard it as overlaid.) It will be seen that the central features and the end flowers are shaded. These shaded parts represent the underlays—that is, different coloured woods inlaid into the background.

Fig. 9 shows the lid overlay enlarged. Indeed, for a small box, this illustration might be regarded as full size. The simplest plan would be to line the shaded parts with silk or very thin veneer, but it is the genuine underlay we suggest for the purpose.

Assuming that the background wood is padouk, and that the overlay is holly, an effective underlay that may be suggested is silverwood. The silverwood underlays are *inlaid* into the padouk, and the overlay afterwards glued on above. As no joint must be visible, the outline

of the underlay must be drawn so that it will come immediately below the solid part of the overlay; but the underlay should have a definite and symmetrical form, as the finished inlay will probably be seen from behind.

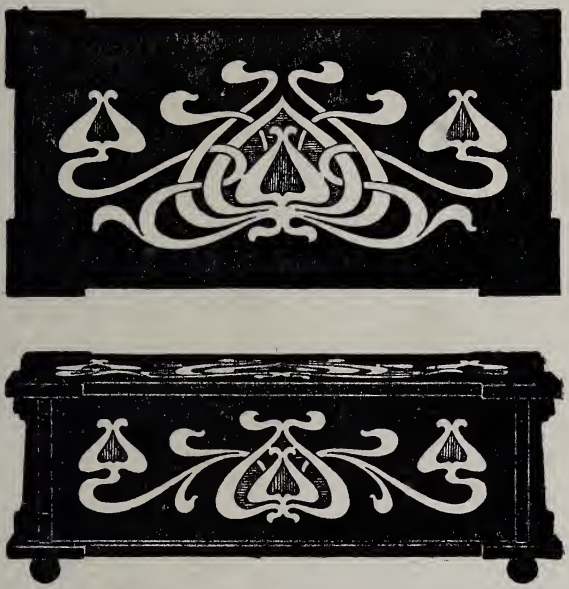

FIG. 8.—TOP AND SIDE OF AN OVERLAID AND UNDERLAID BOX.

When size and position are determined and marked on the background, nail on a small piece of silverwood below and cut out the heart in the double thickness. If cutting is done slightly on the bevel (so that the silverwood heart is a shade larger than the corresponding opening in the padouk) the fit will be close. Glue in the underlay, glass-paper down, and then proceed to fix on the overlay.

This is no fancy method of fretwork enrichment. The writer has adopted the plan dozens of times, and from

FIG. 9.—ENLARGED DETAIL OF OVERLAID ORNAMENT ON LID OF BOX. THE PARTS SHOWN SHADED ARE UNDERLAID—THAT IS, INLAID INTO THE BACKGROUND WOOD.

experience can testify to the effect. Three suggestions, however, may be offered in passing.

In the first place, make sure that the part of the overlay to be backed in this way has a distinct form. The effect (so far as appearance is concerned) of an inlaid underlay is to bind the part so treated together and throw it up as something distinct. If we underlay indiscriminately, we merely rob ourselves of the particular effect we set out to secure. Underlays should only be placed behind distinctive and enclosed parts of the overlay.

Then again, as we are introducing a third colour, we must note the question of balance. It does not do, for example, to crowd several underlays of a dark wood into one corner. This is a matter where judgment must be exercised in the case of each design.

A third hint is not to attempt a large number of small underlays on one design. This would mean considerable labour without the proportionate effect. Silk backing is quite appropriate for small detail, but the inlaid underlay looks better when it is fairly large. In the case of Fig. 9, two different woods might be used for the central underlay.

Odd scraps of finely figured woods are most useful for underlaying—especially fragments of ebonia, rosewood, padouk, lacewood, silverwood and figured maple. Some of them look remarkably well if polished, the general background and the overlay being left plain. With metals and coloured xylonite beautiful effects may also be had.

Backing.—Before passing from this subject, the simpler form of underlaying—backing with silk—may be mentioned. This is most effective in miniature work, especially where an overlay is cut in white xylonite. Fig. 10 shows an ornament which may be treated in this way. The silk is neatly cut to shape and glued or pasted to the back of the overlay. Its edges must not project,

and great care has to be taken not to soil the silk with the adhesive. The entire overlay is then glued down.

The effect of this backing cannot be compared with genuine underlaying, but on dainty articles it is very pleasing if the colours are carefully chosen.

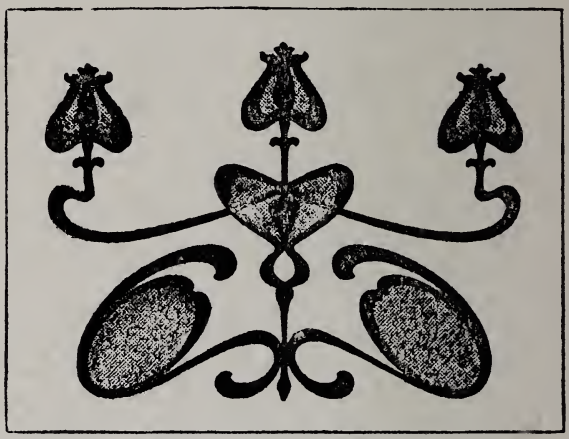

FIG. 10.—OVERLAY PARTLY BACKED WITH SILK.

Jewelling may be termed a kind of relief backing. For fretwork purposes little coloured glass jewels, semi-circular in section and about $\frac{1}{4}$ in. or $\frac{3}{8}$ in. in diameter, may be had. These are glued into circular holes in the overlay, and have a sparkling (if not altogether refined) effect. It is usual to glue a piece of silvered or white paper to the flat surface of the jewel in order to increase its brilliance. Circular jewels, with pins attached for fixing, are also obtainable.

Pictorial Overlays.—The possibilities of the underlay in fretsaw work are nowhere more apparent than when pictorial designs are taken in hand. The success of a fret picture, cut in the ordinary way, is doubtful.

As a rule it looks better on paper than when cut in wood. In the latter case its effectiveness depends chiefly on the background against which it stands. Inlaying, because of the colour combinations obtainable, is suitable for pictorial treatment, and even more striking is the overlay with a partly underlaid background.

The illustration shown at Fig. 11 may be taken as a typical example. It is a sketch design only, and although readers who indulge in miniature cutting might use the illustration as it stands it is intended for a decorative panel from 12 ins. to 18 ins. in length. The part shown in black (the actual design) represents the thin overlay which will be mounted on a solid background, the white portion representing the only part of this ground which will be visible. The tinted portions are underlays—that is, woods of different colour inlaid into the background in order to emphasise the sea and the upper part of the sky.

The whole may be carried out in wood, but the overlay will look better if cut in unpolished white xylonite, which closely resembles ivory, a thickness of $\frac{1}{25}$ in. being most suitable. The general background will, of course, be wood, the thickness being decided upon according to the purpose for which the panel is to be used. As the overlay is white a nice piece of dark walnut may be suggested for the ground. For the sea underlay, silverwood (of a delicate grey colour) is appropriate, while for the part of the sky indicated in tint a darker shade of walnut or a piece of rosewood may be chosen. These are only suggestions, and many other equally good combinations are possible.

When the overlay is cut it is easy to mark the positions for the underlays on the background. In this case the underlaying is very simple, each separate piece being inlaid entire, but in marking out care has to be taken to trace the line so that it will come behind a part of the overlay, and thus avoid any chance of the joint being visible.

FIG. 11.—PICTORIAL OVERLAY, WITH SEA AND SKY PARTLY UNDERLAID.

The parts for the upper sky and sea are inlaid in the ordinary way, the surface afterwards being glass-papered smooth. In the case of the sea a little extra inlaying might, if desired, be done to indicate the boat shadows; this is not really necessary, but it will add to the general effect if carefully carried out. The finished background should be left unpolished.

FIG. 12.—ESCUTCHEON CUT IN METAL.

When the overlay and background have both been thoroughly cleaned they are glued together. If the panel is to be framed, as it probably will, the outer border may be left wider than shown, and the edges secured with fine brass pins. These will afterwards be hidden in the rebate.

INLAYING

INLAYING IN THE SOLID—CUTTING ON THE BEVEL—COMPOUND INLAYS—RELIEF INLAYING—INLAYING WITH THIN WOODS AND VENEERS—INLAID STRINGS AND BANDS—INLAID TRANSFERS—IMITATION INLAYS—WAX-INLAYING

SOME readers are already inlayers; some others, however, are not, and there are many who would eagerly take it up were they only familiar with the way of going about it. There are several ways of doing inlaid work, some of which are easily within the scope of the homefret cutter, and some of which are less suitable for him to attempt. Inlaying with solid wood is different from inlaying with marquetry veneers, and while some classes of the work are best done with the treadle fretsaw, others have to be executed by hand. The tools and accessories required are practically the same as in ordinary fretwork, and, as the work itself is in many ways similar, it is unnecessary to go over ground which has already been covered.

INLAYING IN THE SOLID.

Inlaying with Solid Wood seems easier to the beginner than inlay work with very thin wood or with marquetry veneers. The two principal reasons for this are (1) that solid wood is less delicate to handle, and (2) that the worker is spared the trouble of glueing his inlays to a solid background.

By solid inlaying is meant the letting-in of a fretcut ornament of, say, $\frac{1}{8}$ in. or $\frac{3}{16}$ in. thickness to a background of the same thickness. To do this, the two boards of wood are fixed together, the pattern is transferred to the

upper piece, and then both are cut together. When the woods are separated the ornament which has been removed from the upper board is placed into the corresponding opening in the lower board. It fits exactly, and as the woods are both the same thickness it lies flush with both surfaces, and may be held firm with a touch of glue on the edges.

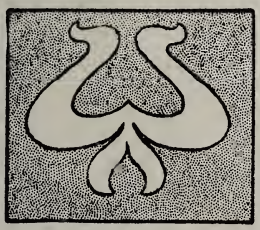

FIG. 1.—SIMPLE INLAY.

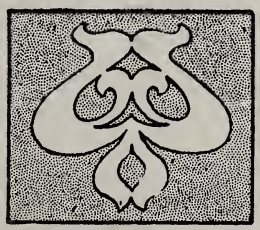

FIG. 2.—COMPOUND INLAY.

Before taking up a first example, we may just point out one little matter which will soon be noticed by the inlayer himself when he proceeds to tackle published designs. If Fig. 1 is examined, it will be seen that the saw-blade can run round the whole outline without having to be re-threaded. This is an advantage that will soon be discovered when a more elaborate piece of inlay is attempted. In Fig. 2, again, is given what we may call a " compound " pattern. The design seems at first sight to be as simple as Fig. 1, but several insertions of the saw have to be made, and this—as will be pointed out later—is a very different matter in inlaying than in ordinary fretwork.

A First Example.—Fig. 3 may be taken as a working example. Let us suppose that it represents an ornament which is to be inlaid into the lid of a box. We may suppose, too, that the box is in $\frac{3}{16}$-in. walnut, and that inlaying is to be done in the solid—in other words, that the ornamental part is to be in a lighter wood also of

$\frac{3}{16}$ in. thickness, and is to be let into the walnut so that the decorative part will show on both sides of the lid. Perhaps the best wood to suggest for the ornament is white maple, and care must be taken to see that it is not *thinner* than the walnut.

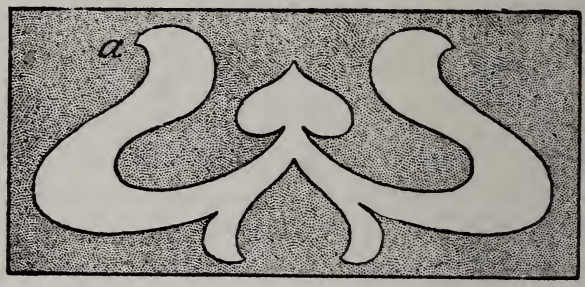

FIG. 3.—EXAMPLE OF A SIMPLE INLAY.

If the ornamental inlay is nearly as large as the lid itself, two boards of wood, similar in size, should be chosen and nailed together. Any inlaying should be done before the outline of the lid is sawn, and it is hardly necessary to add that the nails should be driven into the *waste* wood. Some inlayers prefer to glue the edges of the wood together instead of nailing them. This is quite satisfactory so long as the glue does not encroach on to that part of the wood which is to remain as part of the lid. The pattern is pasted to the upper board.

If the decorative part is quite small, it is needless to waste a large piece of wood on it, and it will be sufficient if a small board of maple is nailed across the walnut. Care must be taken to see that the grain of the maple lies the right way. It need not have the same direction as the walnut, but must be arranged to suit the pattern. When the white piece of wood is to be smaller in this way, it is often better to fix it below, instead of above, the walnut. The reason for this is that the entire diagram,

including the outline of the lid, can be pasted to a flat surface ; whereas, were the small piece of wood fixed on above, the ornamental part of the diagram would have to be cut out with scissors and pasted to the white wood, and the outline portion transferred to the walnut after the inlay had been cut. Cutting in this way, however, means that the white ornament would, when cut, slip up from below instead of passing down from above. This is often carried out in actual practice.

Drilling.—Only one drill hole is necessary, and probably *a* will be the most convenient starting point. The finest possible drill should be used, as any hole will afterwards be visible unless carefully hidden. The plan that the writer adopts is to place the drill as close to the point *a* as it will go without actually touching the line. Hold the drill in a slanting direction, with the point *towards* the ornament. The object of this is that, when the drill has penetrated the maple at an angle, it will strike the walnut just *inside* (instead of just outside) the pattern line. If this happens, no hole will afterwards be seen, for the simple reason that the drill has gone into the waste parts both above and below.

Cutting.—We have spoken of " waste " here, but one of the first things that an inlayer has to grasp in cutting is that there is really no such thing as waste wood. The reason for this is that what is the waste part on the upper board is the solid background on the lower piece ; and that the part below which is afterwards discarded corresponds with the inlay ornament above. Thus, in sawing, there can neither be any deviation from the line nor little excursions into the supposed waste in order to turn a sharp corner. The finest saw must be used, as a coarser blade will remove too much sawdust and thus leave a space between the ornament and its background. The saw, as may be seen, will completely encircle the ornamental part of Fig. 3 without requiring to be

unthreaded; and thus, when the cutting is finished, there are only two pieces to be dealt with—the walnut background, with its irregular central opening, and the maple ornamental scroll which is to be placed in that opening.

As the blade has removed a certain amount of sawdust, the ornament cannot fit very tightly, and will have to be glued round the edges. Of the method for securing a tighter fit we will speak presently. Thus far we have merely described the simplest form of inlaying which can be done even by a hand-frame worker.

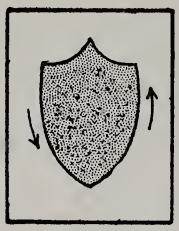

FIG. 4.

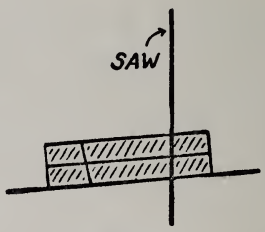

FIG. 5.

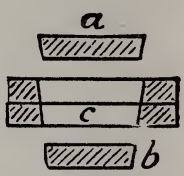

FIG. 6.

CUTTING AN INLAY ON THE BEVEL.

Cutting on the Bevel.—Even the finest blade will remove its own thickness of sawdust, and thus the outline of the ornament must appear as a black line which will be just as thick as the width of the saw. It is to reduce this thickness of outline that the method of cutting on the bevel is adopted.

Bevel cutting means sawing with the blade deliberately off the vertical. In ordinary fretcutting it is often difficult enough to maintain a vertical stroke, and in inlaying it is no less difficult to keep it uniformly at the slight angle required.

The object of this bevel sawing will be understood at once by glancing at Figs. 4, 5 and 6. Assume that a white shield, as in Fig. 4, has to be inlaid into a walnut background. The woods are nailed together (the white

one uppermost), and the cutting table or cutting board tilted to a very slight angle, as shown in Fig. 5. As every one knows, the result of cutting with a non-vertical stroke is that the opening below is either a shade smaller or a shade larger than the opening above. In inlay work the object is to make the lower walnut opening slightly smaller, so that the slightly larger white ornament above will fit tightly into it and thus prevent any apparent width of saw line. If, in cutting the shield with the hand fretsaw, the cutting table is tilted to the left, as shown in Fig. 5, and the saw goes round in the direction of the arrow (Fig. 4), it is clear that the finished pieces will come out like Fig. 6, *a* representing the white shield in section, and *b* the walnut shield. When the boards are separated, *a* will fit very closely into the opening *c* from which the walnut shield has been cut.

Three warnings may here be given to the beginner: (1) If, in using the hand fretsaw, the cutting table is tilted to the *right* instead of to the left, and the saw still goes in the direction of the arrow, matters will be reversed and the inlayer will find that he has a *small* shield to fit into a large opening; (2) if the cutting table is tilted to the left (as in Fig. 5), but if the saw goes in the opposite direction from that indicated by the arrow, there will be the same fatal result—a small white shield and a large walnut opening; (3) In treadle fretcutting it must be remembered that the saw *faces* the worker, and that thus its direction must be the reverse of that taken in hand sawing. This is a matter that requires constant watching. In ordinary fretwork, when the blade is vertical, the direction of cutting is a matter of little importance. In inlaying on the bevel, however, it is all-essential, and before cutting out any ornament the worker should make absolutely sure that his table is tilted to the correct side, and that the direction he takes must correspond.

Bevel cutting is much more easily done with the treadle fretsaw than with the hand-frame. The iron

table is specially adapted for the purpose, and when it is once adjusted to the correct angle the cutting is proceeded with in the usual way.

In determining the angle at which the cutting table or board is placed, the thickness of wood must be taken into consideration. It is clear that, if two boards of $\frac{1}{4}$ in. thickness are being cut together, the angle must be very slight, as there is a distance of $\frac{1}{2}$ in. between the top and bottom surfaces. Thus, if the angle were too great, it would be impossible to drive the upper ornament into the small opening below. On the other hand, this angle might not be excessive if two thin boards of only $\frac{1}{16}$-in. or $\frac{1}{8}$-in. wood were being cut.

The angle, moreover, obviously depends on the size of saw used. The finest blades remove only a hair-breadth of sawdust, and with them only a very gentle angle is required. Coarser blades, again, remove a thicker line, and can thus stand a slightly more acute angle.

The simplicity or elaborate character of the ornament is a third consideration. If the inlaid form is very simple, the worker will find that the total length of line to be cut is only a few inches. A more intricate design, however, which covers no more space, may easily have a line four times as long. This means that four times as much sawdust is removed, and that thus the ornament will fit more freely. Consequently, the elaborate pattern will stand a little more angle.

Apart from the question of a tight fit, the chief difference between vertical and bevelled inlaying is that while, in the former case, two complete inlays can be made, only one set can be completed in the latter case. The object of bevelling is to secure a perfect fit, and it is undoubtedly the most workmanlike method for the fretcutter who possesses a treadle fretsaw.

Saw-blades.—A word may be said in regard to the size of saw-blade. The finest blades are almost invariably

recommended, not only because they remove the smallest quantity of sawdust, but because inlaid ornament is usually finer than ordinary frets, and fine blades are required for the sharp corners and delicate points. These fine blades, however, are more difficult to direct. They are hardly more than fine wire, and there is practically no thickness from the teeth to the back of the blade, which thickness acts as a guide in the case of larger saws.

Saws, such as No. 1 or No. 2, may be easier to cut with, but are less suitable for inlaying as they remove far too much sawdust. For very bold work they might be used, provided that the cutting table were tilted to a sufficient angle, but for ordinary work they are not recommended, and the inlayer should accustom himself to the use of No. 0 or 00. When inlaying is done *without* a bevelled cut only the finest blades must be taken.

Hints on Cutting.—In inlay work the cutting must be all straightforward. Every corner and angle must be turned in the ordinary way, and the blade must never be drawn back so that the second cut of a sharp point may be approached from the opposite direction. The result of this would be a double saw line on the lower board of wood. Nor, in turning angles, must the saw be backed into the waste or allowed to ease itself too freely. This will dig a small round hole in the background, or otherwise injure the corner. In using fine blades considerable difficulty will at first be found with the guiding, and a worker's earliest attempts should be with patterns which are not severe or geometrical. If saws break (and they are pretty sure to) care must be taken not to let a broken piece remain in the saw-cut, as in sawing past it the line might be injured.

As the cutting nears its completion, vibration increases, especially if the pattern is elaborate. The bevelling prevents the cut fret from a downward tendency, and the fingers should be used to keep it from starting

upwards. Breakages in inlay work are less fatal than in ordinary fretwork, but still a break is apt to leave a scar on white wood, and every care should be taken to preserve the ornament intact.

When the cutting is completed, the woods are turned over and the ornament gently pushed out. They are, of course, separate by this time and the delicate inlay should be carefully laid aside. The two main boards may then be separated and the ground one laid out to receive its inlay.

Glueing.—It does not much matter whether the glue is applied to the edges of the background or the inlay. For preference we should suggest glueing the ground wood, for the same reason that we glue a mortise instead of a tenon. The glue should be applied with a small camel-hair brush and need not be too thick. If the bevel has been sufficient to make the inlay fit tightly of itself glue is only required to prevent it afterwards starting out of position from exposure to sun or other heat. Glueing should be done rapidly.

The inlay ornament is then taken and pressed into its place. If at all tight a board of wood should be laid above so that the pressure is evenly distributed ; if very tight a few taps on the board from a hammer will do no harm. When it is seen that the inlay is flush at all points, the work should be laid aside and kept flat under a weight until the glue has thoroughly set. A sheet of clean paper should be on each side to prevent the wood adhering to anything else.

Both surfaces are then well cleaned with glass-paper. This work is a little tiresome, but must be done thoroughly. Should any trace of the drill hole be visible on the ground wood it may be filled up with a paste made of sawdust and glue.

A Compound Inlay is one in which the ornament is "tied" like an ordinary fret, and requires several

separate insertions of the saw, or one which is to be cut in more than two woods. If we regard Fig. 7 as the holly inlay for the lid of a walnut box, it will be seen that the interior portion of the background must necessarily be split up into a number of separate parts. Thus it is

FIG. 7.—EXAMPLE OF A "COMPOUND" INLAY.

clear that, while the general holly ornament *goes down* into the walnut, the interior parts of the walnut background must *come up* from below. If the interior parts were cut in the same way as the outline (the table tilting to the same side, and the saw cutting in the same direction), it is obvious that the holly part cut away would be larger than the corresponding walnut part, and that thus there would be a misfit. What has to be done in the case of these interior parts is to let the saw travel in the opposite direction from the route it takes in the case of the outline. If preferred, the saw could be sent in the same direction, and the table tilted to the opposite side; but it is better to keep the table fixed permanently when

its proper angle has been determined, and secure correctness in the bevel by altering the direction of the saw.

When all the interior parts have been sawn, the outline may be taken. The saw must go round the opposite way, as the entire white ornament has to go down into the walnut opening. These differences of direction may perhaps seem confusing to the reader, but in practice they are easy to follow.

In glueing the ornament in position, the work must be done quickly. The holly inlay should first be placed in position, great care being taken to see that both surfaces are flush. Do not wait until the glue has set, but proceed at once to turn the work over and fit in the walnut pieces which form the interior background. Without these the inlay may not adhere closely, and it is desirable to have everything tight before the glue hardens. Of the interior parts, the largest and most elaborate should first be put in.

Three-Colour Inlay.—Thus far, too, we have been speaking of solid inlaying, where boards of from $\frac{1}{8}$ in. to

FIG. 8.—SKETCH EXAMPLE IN THREE COLOURS.

$\frac{1}{4}$ in. are inlaid into backgrounds of the same thickness. We have also been dealing solely with those examples where only two colours of wood have been used, one for the ground and one for the inlay decoration.

A very simple example of a three-colour inlay may

now be given. By referring to Fig. 8 it will be seen that three woods in all are required, one for the background, a second for the spray, and a third for the flower. Let us just assume that dark walnut is again chosen for the ground, that white holly is taken for the spray and satinwood for the flower. It will also be noticed that, although there are two separate overlays, neither has any interior piercings. Only two drill holes will be necessary, one for the spray and one for the flower.

The first idea of the worker might be to nail the three woods together and cut all at once. But with hard woods like holly and satin the cutting would be heavy, and with both flower and spray there would be an unnecessary thickness to cut through. What should therefore be tried is to saw the walnut and satinwood together for the flower inlay, and the walnut and holly together for the spray. If this is done the pattern must be pasted to the walnut—the background wood.

When the entire pattern is pasted to the background wood, it means, of course, that the inlay ornaments, when cut, come up into position from below. Thus the tilting table must be so adjusted, and the saw directed, that the under ornament will be just a shade larger than the upper walnut opening.

It is better to deal first with the flower. Paste the whole pattern to the walnut, fix on the satin board below, and drill a hole. Cut right round the flower, and then separate the woods. Now fix on the holly board below the walnut, and proceed to saw the spray. To afford protection to the wood, the *walnut* flower may be put back into the opening from which it has been cut. Drilling may be done at any corner of the spray, and the saw-blade run round the spray.

The cutting completed, the walnut and holly boards may then be separated, the former laid *face downwards* on the bench, and the inlays glued in. The spray, being the more delicate of the two, should first be placed.

Both surfaces may afterwards be thoroughly glass-papered.

Combined Colour Inlays.—The example just given is one where there were two detached ornaments, neither of which had any interior piercings ; a different colour of wood was chosen for each, and each was inlaid separately.

FIG. 9.—INLAY WITH INTERSECTING PARTS.

When different colours are required for ornamental parts which touch each other, or intersect, it is clear that the case is a little more complicated. At Fig. 9 is shown an inlay of this description. It is only a small piece of detail, but as the ball part of the conventional flower touches the spray parts at two points, it will be seen that special care will have to be taken to secure absolute accuracy.

What the worker has first to decide is which colour he should first inlay—the ball or the flower spray. And just here it may be assumed that we are still speaking of inlaying in the solid : that the frame background is $\frac{3}{16}$ in. thick, and that decorative parts of the same thickness are to be inlaid into them.

Now there are several ways of cutting this inlay, one of which may be explained. In the first place, let us choose the same three woods—walnut for the ground, satinwood for the spray, and holly for the ball part.

The first method that may be suggested is to first cut out the white ball. Paste the pattern to the background, and to the underside fix a piece of holly.

If the detail at Fig. 9 is now looked at, it will be seen that, while the lines *a* and *b* of the white ball touch the background, the parts *c* and *d* touch the satinwood spray. As the spray is not at present being dealt with, it is obvious that it will be better meanwhile to leave the whole outline of the part *d* undisturbed. The line *c* is so small that it is of little consequence. What will be found advisable, then, is to pencil a line on the solid *d* part, as shown by the black dotted lines. Drill a hole (boldly, for it will not afterwards be seen) at *e*, and cut by the dotted line right round *a*, *c*, *b*, and back to *e*. Remember that the holly ball has to come up from below.

A moment's thought will show the reader the advantage of this method—a method which at first sight may appear to give unnecessary trouble. He has cut out his ball, but at the same time he has left the important part *d* uncut. As *d* belongs to the holly and satin woods, and not to the background at all, he has thus saved himself the delicate task of cutting the outline *d* twice. (By *d* we mean the part of the spray outline which touches the ball.) When the holly ball has been placed in position, and the satin board fixed on behind, the part *d* can then be cut.

Just here, however, there are two important points to note. The diagram of the little part *d* has been cut away; and as it is still required the waste walnut may be gently damped and the pattern peeled off. An alternative, and perhaps a better plan, is to make a tracing beforehand. A second point is that the projecting part

f, which is detached from the general spray, has to be cut, and that it is desirable to do this before the holly ball is glued in.

The plan to follow is this: When the ball is cut, remove the waste holly board from behind, and fix on a little piece of satinwood behind the background for the part *f*. A hole must be drilled for this, but as it need only go through the satinwood waste in the middle of the ball it gives no trouble. Cut out *f*, taking care that the saw goes round in the direction required to make the satinwood ornament a shade larger than the walnut opening. Be careful also of the little line marked *c*. Then separate the woods, and glue the holly ball and the satin part *f* into position, and proceed to the general spray.

The position so far is this: Practically the entire pattern is still on the background; the ball and *f* part have already been inlaid in position; and the diagram of the *d* portions is missing. This *d* part, if preserved from the pattern, must now be pasted carefully in position; or, if a tracing has been kept, draw the outline on the holly. The satinwood must then be fixed behind the walnut, and the spray cut, it being borne in mind that this also comes up from below.

When *d* is approached, the holly really forms the background. The holly and satinwood are cut together, and thus the ball is completed with a clear outline instead of a ragged one, as might have been the case had it been sawn twice over.

When inlaying is done with woods of ordinary fretwork thickness (say, $\frac{1}{8}$ in., $\frac{1}{16}$ in., or $\frac{1}{4}$ in.) it is clear that difficulties must accumulate when more than two colours are wanted for the ornamental parts. Such inlaying is almost invariably done with thin overlay woods, or with veneers, which can all be cut together; whereas, in solid inlaying, more than two pieces can rarely be cut together.

It is not the mere introduction of different woods that causes the trouble; it is the fact that these different woods touch or intersect each other. What has to be avoided as much as possible—but what cannot always be avoided—is the cutting of any of these division lines twice over. If, however, each design is carefully studied beforehand, the problems which have taken much space to explain will appear simpler.

Relief Inlaying.—This means the inlaying of a background of, say, $\frac{3}{16}$-in. wood with an ornament $\frac{1}{4}$ in. thick. The result of this method is that the ornament on one side appears to be inlaid, while on the other side it looks like an overlay, the decorative part standing out $\frac{1}{16}$ in. in relief.

The worker will see at once that it is only worth while going to the trouble of doing this when both sides of the article are to be visible. If the front alone is to be seen, the labour of inlaying is unnecessary, as the ornament on this side looks only like an overlay. If, however, both sides will be open to view, the method is strongly recommended. The lid of a box is a good example of an article on which the plan may be adopted. The upper surface is admirably suited for an overlay, while the inner surface will look well when inlaid. The plan has the additional advantage of affording a surprise to any one who handles the lid, as the inlaying is not noticed until it has been lifted off, and the underside is seen.

The work has no peculiar difficulties, and if ordinary care is observed any fretcutter can undertake it. A hard and close-grained wood is necessary for the ornament. If a soft or grainy wood is used, the edges of the relief parts are apt to get dented or frayed. It must also be seen that the ornament is sufficiently thick to permit of the projecting part standing out its correct height in relief.

Inlaying of this sort is much more easily done by the

treadle worker than by the hand-cutter. The reason for this is that a slightly bevelled stroke is almost necessary, as the inlay must fit very tightly into the walnut. If it is at all loose, there will be the greatest difficulty in getting the ornament to lie exactly flush with the underside; and the mere fact that the upper side is in relief makes the inlay more liable to pressure from above.

When the cutting is completed, the order of procedure must depend on what particular finish is to be given to the lid. If the wood is to be left quite plain, the rest of the work is straightforward. The upper surface of the background is thoroughly glass-papered and the edges of the inlay cleaned. The edges of the ground opening are then touched lightly with glue, and the inlay pressed into position. No glue should be applied direct to the inlay, as on no account must any of the adhesive be left on the edges of the relief part. The inlay must be pressed in till it is fully flush with the lower surface. It need not project perceptibly, but it must be sufficiently through to allow of its being glass-papered perfectly flush with the background after the glue has hardened and the inlay is set. The relief ornament on the other side may then be gently glass-papered, the greatest care being observed not to round any of the edges.

If the lid is to be polished, bright or dull, a different method must be followed. First glass-paper the upper background surface and carefully polish it to the finish required. Then, after attending to the edges of the ornament, glue the edges of the ground opening, and place the inlay in position. Leave the work until the glue has set, and then proceed to glass-paper and polish the underside. It is assumed that the relief ornament will, for a contrast, be left plain.

THIN WOODS AND VENEERS.

Inlaying with Thin Woods.—To the professional

marquetry cutter, who saws many thin veneers at a time, the inlaying of wood in the solid may seem heavy and laborious. There can be no doubt, however, that it is the easiest method for the amateur. Veneer inlays have to be glued down to solid surfaces, and where the work is large and the ordinary amateur has no equipment for securing the necessary pressure, it is sometimes difficult to get a surface which will be lasting.

Between inlaying in the solid and marquetry veneer cutting, however, there is an intermediate alternative. This is the use of the widely-known overlay boards, which are provided in thicknesses of $\frac{1}{16}$ in. or less.

So far as inlaying is concerned, this overlay wood has two advantages : it is solid, and yet so thin that several layers may be cut at once. The beginner at inlay work will readily understand that the disadvantage of solid inlaying is the difficulty of cutting more than two pieces at one time. It is comparatively easy to cut four layers of $\frac{1}{16}$-in. wood, provided they are firmly nailed together. Then the disadvantage, to the amateur at least, of marquetry veneers is on account of their being so thin and brittle. Overlay wood, on the other hand, although necessarily fragile, is not troublesome to handle ; it is material which the fretcutter uses every day, and which he thoroughly understands.

Sixteenth-inch wood may, of course, be employed for solid inlaying. That is to say, it may be used in the way already described, the ornamental parts being inlaid into their backgrounds after being cut with the tilting table at a slight angle. If the articles being made were very small, and if the inlay fitted tightly, such ornaments might be left unsupported by a background. In the case of larger articles, the finished inlay would, of course, be glued to a more solid ground.

The general advantage of overlay woods, however, is that, as several boards of different colours may be cut

together, the same number of complete inlays (similar in design, but differing in colour arrangement) may be finished. This will mean of course that the cutting table cannot be tilted, as the work throughout must be cut with a vertical stroke. The reason for this is obvious. It is not a case of one slightly larger part fitting into a smaller opening ; all parts must be interchangeable, and thus all parts must be alike.

This may seem a cheap, quick, and comparatively easy way of turning out inlay work, but, of course, it is not always wise (although it may be quite possible) to complete as many panels as the number of different woods used. In the case of a purely geometrical design each different arrangement might look well ; but if the pattern were a conventional or floral one, only three or four combinations might be suitable ; while, were it a pictorial one, probably not more than two different arrangements would be appropriate.

This is an important point to bear in mind, because it largely determines the worker's method of procedure. If he is using several woods, and wishes to complete as many inlays, it is clear that, as all the parts must necessarily be interchangeable, he must cut throughout with an absolutely vertical stroke. If he is to complete only one panel, then he may tilt the table and cut as in solid inlay work.

When it comes to glueing the parts together, it is customary to glue a sheet of paper to the back of the background. Glue all the pieces well, and fit them into their respective positions, place a second sheet of paper on the top, and lay the whole under heavy pressure until thoroughly dry. In the case of the bevel-cut inlay, it is not so necessary to have the paper over the back, as the parts themselves will all fit closely. Paper, however, should always be laid over the bench in order to prevent the inlay from adhering to the wood. If, in the case of the vertical-cut inlays, the paper on the back is not to

be removed, it must be seen that the different parts are thoroughly well glued to it.

When the glue has set the complete inlaid panel may be glued to its solid background. Battens are usually screwed to the back to prevent any chance of the solid background warping with the pull of the glued panel.

Pictorial Inlays can be carried out very effectively in thin woods. An example which will suggest several alternative methods of treatment is shown at Fig. 10. The choice of suitable woods is, of course, a matter of the greatest importance. Inlaying is more than fretcutting. It is, in a sense, a pictorial art, and the result of one's work depends on the careful selection and artistic arrangement of woods as much as on the actual workmanship.

FIG. 10.—PICTORIAL INLAY.

Marquetry. — The finely inlaid panels we see on costly articles of furniture are examples of marquetry work. The marquetry cutter is a craftsman who devotes his whole time to the work, and his materials and methods are very different from those just described. He works with thin veneers and cuts, not with a treadle saw, but with a special saw frame. Sometimes he makes his own saw-blades from fine clock-spring steel. His work bench is known as a marquetry cutter's " donkey," which is a combined stool and frame. The frame has a clamp which holds the veneers, the jaws of this being operated by a treadle so that the work can be turned as required. The saw, also attached to the frame, works horizontally, and can be adjusted to cut on the bevel. The cutter sits

FIG. 11.—TRAY WITH MARQUETRY PANEL.

as on horseback, guiding the veneers with his left hand while he operates the saw with his right.

The parts, when cut, are shaded by scorching. A tin of fine sand is heated, and into this the veneer is dipped again and again till it is shaded as required. With due care a delicately graduated tone is obtained. The parts are afterwards arranged and glued to paper, when the panel is ready for glueing (as in veneering) to its background. Stained veneers may be had in all colours, so that the expert marquetry cutter can reproduce almost any design in naturalistic colours.

Marquetry of the simpler character can be carried out at home by any fretcutter; but, if he is to be able to make use of his work to the best advantage, he requires to have the proper facilities for veneering—that is, the means of glueing his veneer panels to a solid ground.

Boulle Work (called after its inventor, who produced many magnificent pieces of art furniture for Louis XIV. and Louis XV.) may be mentioned in passing. In one sense it is similar to marquetry, but the feature of Boulle's work was the inlaying of metal (brass and silver, afterwards engraved) into a background of tortoiseshell. Several beautiful examples will be found in the Wallace Collection, London.

Intarsia is similar in effect to parquetry flooring on a small scale. It consists of carefully-studied arrangements of the grain so as to produce perspective effects. The result is, of course, largely dependent on the choice of colour and on the placing of the grain.

Inlaid Furniture.—In this chapter the word "inlay" has been used in its general sense; but, technically, "*in*-laying" really means the letting a thin piece of ornament into solid wood. The inlay—it may be a mere veneer—is first cut—usually with a slightly bevelled edge. It is then placed in position, a fine line scratched around, and a space hollowed out to receive it. Mother-

o'-pearl and ivory are in this way used for inlaying as well as wood, and pewter is a favourite metal to inlay into oak furniture.

INLAID STRINGS AND BANDS.

Strings and Bands.—Veneering* is beyond the scope of this volume, but fretcutters can occasionally make effective use of inlaid strings and bands.

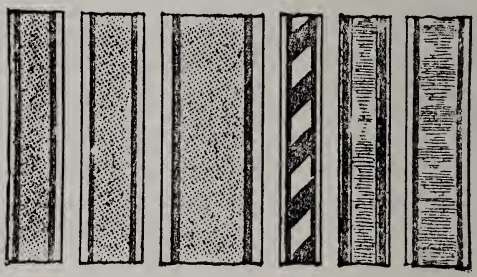

FIG. 12.—INLAID BANDS.

Stringings for inlay work are usually sold in lengths of 3 ft. They may be had in satinwood, box, black and other colours, in widths from $\frac{1}{32}$ in. or $\frac{1}{16}$ in. upwards. Wider bands, from $\frac{3}{16}$ in. up to $\frac{3}{8}$ in. or more, are made up of different colours, many of them very beautiful in combination. Some of the wider ones are in satinwood, harewood, kingwood, tulipwood, etc., with narrow borders of white, black and yellow; others have geometric patterns in great variety. The effect is usually heightened by having the grain of the inner wood running crossways instead of lengthways. Work on which these bands are inlaid is usually polished, but when a black and white chequered inlay is used on oak a dull waxed finish is regarded as preferable.

* See companion volume on "Details of Cabinet Construction."

In the case of these stringings and bands the fretsaw is not required. No saw work is needed except to cut the bands to their exact length, and this may be done better with a sharp chisel or a penknife. The stringings are only about $\frac{1}{32}$ in. thick, but they are quite easily handled and do not readily split. They are not *cut into* the background in the way described for ornamental designs, but a shallow groove is run for them, and they are then glued and pressed in.

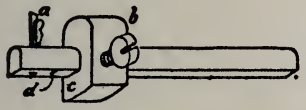

FIG. 13.—CUTTING GAUGE.

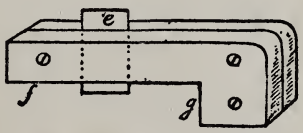

FIG. 14.—ROUTING TOOL.

We are not here addressing experienced cabinet-makers or regular marquetry cutters. We are speaking for the fretcutter, and what we wish to explain is how these stringings may be used without having to buy expensive tools or appliances. Let us assume that the worker has made a fretwork table which has a plain square top, or, it may be, a top with shaped edge and centre fretting, but which has a sufficiently wide margin to allow for an inlaid border.

Take the top and cut it perfectly square, the edges being true. Fret the centre (if it *is* to be fretted) at this stage if desired, but do not cut the shaped edge. Mark in pencil the line for the inlaid band, say, 2 ins. from the edge. What is now wanted is to sink a groove about $\frac{1}{32}$ in. deep and just wide enough to take the inlay. A cutting gauge (Fig. 13) is the best tool to use for this.

Suppose that a plain boxwood line, $\frac{1}{16}$ in. wide, is to form the inlaid border. At Fig. 13, *a* is a cutting knife with a $\frac{1}{16}$-in. edge. (Various sizes of knives are, of course, obtainable.) By means of a wedge the knife may be so

adjusted that only $\frac{1}{32}$ in. of the cutting point projects. At *b* is a movable head which, by means of a screw, can also be adjusted so that the face *c* is exactly 2 ins. from the knife. Now, if the cutting gauge is held with the stock face *d* resting flat on the table top, the face *c* sliding along the edge, the knife will groove out a line $\frac{1}{16}$ in. wide, $\frac{1}{32}$ in. deep, and exactly 2 ins. from the edge of the table. Great care must be taken at the corners to see that the knife does not go beyond the pencil mark.

It ought to be said that the width of the groove should be just a hairbreadth less than the inlay in order that the latter may have to be forced in. The depth, too, should also be slightly less than the thickness of the inlay, to provide against the " draw " of the glue and also to allow for glass-papering.

When a wider band is to be inlaid (say $\frac{1}{2}$ in.) two fine cuts are run with the gauge, one at each outside edge. The intermediate channel may then be routed out with a home-made " scratch tool." To make this tool, cut two bits of hardwood about 4 or 5 ins. long, and screw them together like Fig. 14. The part *e* is a small piece of hardened, thin steel, rather less than $\frac{1}{2}$ in. wide, firmly held between the two pieces of wood. It is adjusted in the same way as the gauge knife ; the flat edge *f* rests on the wood while the vertical edge *g* acts as the edge *c* in Fig. 13.

In cutting the strings or bands, care must be taken to have them the right length and to mitre the corners neatly. The grooves are then well glued and the bands pressed in and rubbed firmly down with the flat head of a heavy hammer. As the glue draws the inlay down no glass-papering should be done till the work is thoroughly set. The edge of the table, if to be shaped, may then be cut and the work finished off.

Inlaid Transfers.—These are examples of imitation inlays, taking the form of very thin films which are mounted on paper in such a way that they can be

transferred permanently to the wood. They are grained and coloured to represent natural woods, and if used judiciously on unfretted panels, they are wonderfully effective. The method of laying these transfers is as follows:

If the wood is to be left unpolished, it is carefully finished with glass-paper. If to be finished bright, it is first "bodied up" (see under french-polishing) and allowed to thoroughly harden. It should then be slightly rubbed down with a little powdered pumice stone in the direction of the grain. The transfer is dipped in a solution of gelatine and water (½ oz. of gelatine to one pint of water) and pressed well down on the wood, care being taken to work out any air bubbles. Leave the transfer to thoroughly dry and then take a damp sponge and saturate the back. After the water has soaked through the paper, gently lift one corner and gradually lift the entire paper away. Do not attempt to *slide* the paper off, or failure will result. Carefully wipe away any slimy matter around the transfer and leave it to dry. If to be polished, the transfer, when set, can be fastened by applying at intervals two coats of thin white polish, which should be applied with a camel-hair mop brush in a similar manner to fastening after colouring up. When dry, finish with the rubber in the ordinary way.

Imitation Inlays.—A method, sometimes adopted in special cases, of securing imitation inlays with solid wood is to cut out the entire pattern from one board of, say, white maple or sycamore. When the parts are separated, stain them as required—some walnut and some satin-wood as the case may be. When the correct colours have been obtained, glue the parts together. Work of this sort usually requires to be polished.

Wax-Inlaying is really a form of decoration applied to overlays, selected interior parts of which are filled

with coloured wax. The wax is gently dissolved by heating, and, when liquid, is poured into the openings.

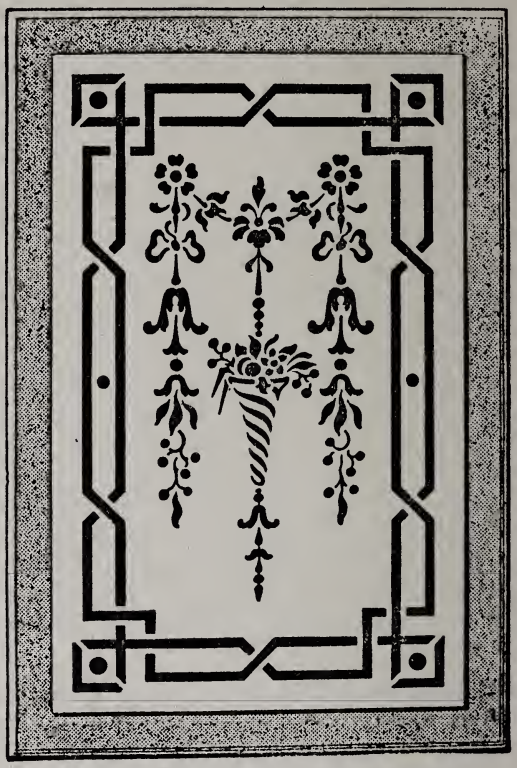

FIG. 15.—EXAMPLE OF WAX-INLAYING.

When set, it is glass-papered flush with the wood. Fig. 15 shows a panel treated as a stencil. The parts shown black are cut out and afterwards filled with the wax.

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